# The Determinants and Consequences of Solitary Confinement: Risk Factor, Future Criminal Justice Involvement, and Mortality

by

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# ABSTRACT

Dramatic growth of the prison population in the United States over the last four decades accompanies significant qualitative transformations in the conditions of imprisonment. At this historic moment, some of the most extreme forms of punishment are not only tolerated but embraced – often without critical considerations of their effectiveness, nor their potential collateral consequences. Indeed, prisons have become focused less on rehabilitation and more on punishment and containment. The startling, expanded use of solitary confinement exemplifies this trend toward more punitive penal practices. Despite widespread use, the determinants and consequences of solitary confinement have not been thoroughly investigated. This study leverages rich administrative data on individuals who were sentenced to prison and observed over time to investigate: the risk factors of exposure to solitary confinement, its effect on future criminal justice contact, and long-term consequences on mortality after release from prison. Analyses offer several key findings: First, net of key factors predictive of behavioral risk, solitary confinement disproportionately concentrates some of the most vulnerable and disadvantaged inmates, including individuals with mental illness. This underscores the persistence of disparate treatment in the workings of the criminal justice system. Second, solitary confinement significantly increases the likelihood of reoffending, including violent crimes. Because the majority of prisoners are eventually released back into the community, high rates of reoffending suggest that in the long-run solitary confinement threatens public safety. Third, any

exposure to solitary confinement significantly elevates the risk of mortality after release, and this is driven in large by premature injury-related mortality, including homicides, suicides, and transportation accidents. Together, this research contributes to existing literature by identifying solitary confinement as a particularly consequential experience that intensifies the impacts of incarceration and that has significant implications for understanding social inequality, public safety, and public health.

# INTRODUCTION

There has been extraordinary growth in incarceration over the last four decades in the United States. In 1972, the incarceration rate (the number of individuals in prisons and jails per 100,000) was 161 but dramatically rose to 707 per 100,000 in 2012. In total, more than 2.2 million people were in custody in 2012 (Glaze and Herberman 2013). The incarceration rate in the U.S. is among the highest in the world, and its prison population accounts for over 20 percent of the global prison population (Walmsley 2013). Prior research has attended to the consequences of incarceration for individuals, families, communities, and society at large (e.g., Alexander 2010; Morenoff and Harding 2014; National Research Council 2014; Uggen and Manza 2002; Wakefield and Wildeman 2014). Despite the rich volume of research on mass incarceration, we still know surprisingly little regarding the nature of the time individuals spend imprisoned, such as time spent in solitary confinement, and the consequences of these experiences, particularly for well-being and reentry into the community. Indeed, a recent comprehensive review of existing research by the National Research Council concluded that, while there is considerable heterogeneity in the experience of imprisonment, "detailed knowledge about the spectrum of conditions of prison life is sparse" (National Research Council 2014:353).

Solitary confinement represents one of the most consequential, yet under-examined, experiences of imprisonment. Individuals subjected to solitary confinement are held in small

cells for 22-24 hours a day with little or no opportunity for meaning social contact and engagement, including access to work, educational, and therapeutic programming. There is growing evidence that exposure to solitary confinement, especially long-term stays, is associated with risks of self-harm and lasting psychological impacts, including anger, aggression, anxiety, depression, hypersensitivity to external stimuli, and even psychosis (Arrigo and Bullock 2007; Grassian 1983; Haney 2003a, 2012; Kaba et al. 2014; Lanes 2009; Rhodes 2004; Smith 2006). The consequences of solitary confinement on other domains of life long after individuals are released from prison are less understood, but adaptations to life in such restrictive and extreme conditions likely further exacerbate the challenges of reintegrating into society after release.

There have been concerns among advocates, policymakers, and administrators regarding overuse, costs, and disparate treatment (ACLU 2014a; Haney 2003b; Obama 2016; U.S. Congress 2012; U.S. Department of Justice 2016). National estimates from survey data indicate that solitary confinement is not an uncommon feature of imprisonment (Beck 2015). Data show that 4.4% of state and federal prisoners and 2.7% of jail inmates (together, over 80,000 inmates) are held in solitary on any given day. Between 2011-2012, almost 20% of prisoners and 18% of jail inmates (over 400,000 inmates) have spent time in solitary in the past 12 months (Beck 2015). Moreover, use of solitary confinement is rising. The growth rate of prisoners held in solitary confinement surpassed the growth rate of the overall prison population (Gibbons and Katzenbach 2006). Solitary confinement units are very expensive because the operating per capita costs can be double or triple the costs of regular security units due to enhanced security and staffing requirements (Shames, Wilcox, and Subramanian 2015). Finally, solitary confinement units house a disproportionate share of disadvantaged and vulnerable individuals, including those with mental illness (Fellner 2006; Frost and Monteiro 2016; Haney 2012; Kupers

1999). These concerns, furthermore, warrant a closer investigation of the determinants and consequences of solitary confinement.

There have been serious questions regarding the effectiveness of solitary confinement. Although use of solitary confinement is intended as a strategy to manage risk and ensure safety in prisons, it has not demonstrated significant reductions in subsequent institutional misconduct or violations (Briggs, Sundt, and Castellano 2003; Labrecque 2015; Morris 2016). More rigorous research is needed to assess the penological aims of solitary confinement, such as deterrence of future misconduct, as well as the long-term impacts on criminal justice involvement.

The extreme levels of deprivation associated with solitary confinement calls more research on solitary confinement. Investigating the nature and consequences of prison life in general, and solitary confinement in particular, has important implications for understanding punishment and inequality. Imprisonment is a heterogeneous experience, in which individuals are subjected to different confinement conditions, policies, and practices. Examining such variations contributes to a better understanding of the heterogeneity of exposure to imprisonment, and in turn, helps explain differences in individual outcomes, such as recidivism and mortality after release. This approach is timely because not only has the criminal justice system widened in scope, it has also become more punishing. In particular, penal practices have grown increasingly punitive, yet their short- and long-term consequences are not well known. Solitary confinement deserves particular attention because it represents one of the most intense levels of correctional control and social deprivation. Focusing on this extreme practice provides an opportunity to investigate how the nature of imprisonment shapes behavior and impacts reentry.

The scale, severity, and ramifications of imprisonment are disproportionately borne by the most disadvantaged segments of the population. Minorities, the poor, and those with little education are overrepresented in the criminal justice system. Examining the severity of confinement conditions offers insight into how imprisonment leads to outcomes that in turn contribute to inequality. More than mere facilities where offenders serve their time, prisons are powerful social environments that exact significant physical, psychological, and social tolls on individuals who cycle through them, both in the short- and long-term after they are released (National Research Council 2014). Increasingly, evidence suggests that exposure to prison environments is detrimental to one's health and mortality (Massoglia and Pridemore 2015), normalizes anti-social norms (Lerman 2013; Toch and Adams 2002), strains relationships with family and friends (Comfort 2008; Wildeman and Muller 2012), damages employment prospects (Western 2006), alienates individuals from society (Weaver and Lerman 2010), and ultimately contributes to stratification and inequality (Wakefield and Uggen 2010). In short, prisons can further marginalize some of the most vulnerable members of society. Whether the experience of solitary confinement intensifies the intended and collateral consequences of imprisonment requires more investigation.

A growing body of research has linked social connectedness to individual well-being, and the health consequences of prolonged social isolation warrants more investigation. Investigating solitary confinement offers a case to directly link exposure to long-term social isolation and individual well-being. Much of this research has focused on social isolation among older adults, an especially vulnerable population because of higher morbidity and mortality (e.g., Cornwell and Waite 2009; Steptoe et al. 2013). Prisoners represent another large and vulnerable population because of the health consequences of imprisonment and because they are separated by distance

and time from their networks of support. Prisoners in solitary confinement are an extreme case of (forced) social isolation because of restrictions on their social interactions with other prisoners and contact with family, friends, and other sources of social support on the outside. Studying this group offers an opportunity to explore one avenue – social support (or the lack thereof) – through which social isolation impacts well-being.

Despite widespread use of solitary confinement, its determinants and long-term consequences are not well known (Frost and Monteiro 2016; Mears 2016). To date, there are few population-level analyses of factors associated with exposure to solitary confinement (see Butler and Steiner 2017; Cochran et al. 2017; Olson 2016), and even fewer on the effects of such treatment long after release from prison (see Lovell, Johnson, and Cain 2007; Mears and Bales 2009). Limited research on this topic stems in part from an underappreciation of the heterogeneous experience of imprisonment, difficulty of gaining access to data on solitary confinement, and methodological challenges with regard to selection bias. This study seeks to advance the literature by: (1) unpacking the "black box" of imprisonment and considering it as a heterogeneous "treatment" rather than a uniform one; (2) examining multiple dimensions of exposure to solitary confinement; (3) assessing potential disparate treatment; (4) evaluating impacts on multiple life outcomes, including crime and mortality; and (5) leveraging largescale administrative data to generate more precise estimates.

This dissertation addresses existing gaps in knowledge through three papers that aim to examine the risk factors of exposure to solitary confinement (Chapter 1), its effect on future criminal justice contact (Chapter 2), and long-term consequences on mortality after release from prison (Chapter 3). First, I find that, net of key factors predictive of behavioral risk, solitary confinement disproportionately concentrates some of the most vulnerable and disadvantaged

inmates, including individuals with mental illness history. This underscores the persistence of disparate treatment in the workings of the criminal justice system. Second, I show that solitary confinement significantly increases the likelihood of reoffending, including violent crimes. Because the majority of prisoners are eventually released back into the community, high rates of reoffending suggest that in the long-run solitary confinement threatens public safety. Third, I find that any exposure to solitary confinement significantly elevates the risk of mortality after release, and this is driven in large by premature injury-related mortality, including homicides, suicides, and transportation accidents. Together, this research contributes to existing literature by identifying solitary confinement as a particularly consequential experience that intensifies the impacts of incarceration and that has significant implications for understanding social inequality, public safety, and public health.

# CHAPTER 1

## THE RISK FACTORS OF SOLITARY CONFINEMENT

## Introduction

Research has examined and detected bias related to social status in various stages of the criminal justice process, including policing, prosecution, and sentencing (Abrams, Bertrand, and Mullainathan 2012; Bushway and Piehl 2001; Mustard 2001; Starr 2015; Steffensmeier, Ulmer, and Kramer 1998; Ulmer, Kurlychek, and Kramer 2007; Yang 2015). Such research suggests that extra-legal factors (such as race, age, and gender) have a significant bearing on the kind and severity of punishment one experiences in the criminal justice system. Despite this attention on bias in the workings of the criminal justice system, there has been not adequate research on potential disparities with regard to sanctions and punishments that occur in prison. Indeed, there is recognition that more research is needed to unpack the heterogeneous experience of imprisonment, including exposure to varying severity of confinement conditions (National Research Council 2014:353).

The widespread use of solitary confinement and its associated consequences necessitate a close examination of the risk factors that select individuals into such exposure. Over the last several decades, there has been an extraordinary proliferation of solitary confinement (Reiter 2012). In 1989, California opened one of the first supermax facilities (where nearly all inmates are held in permanent isolation) at Pelican Bay State Prison. By 1999, more than 30 states operated some form of supermax facilities, in addition to separate isolation units within existing

facilities (U.S. Department of Justice 2016:7–8). Moreover, recent national estimates indicate that solitary confinement is common feature of imprisonment (Beck 2015). Data show that 4.4% of state and federal prisoners and 2.7% of jail inmates (together, over 80,000 inmates) are held in solitary on any given day. Between 2011-2012, almost 20% of prisoners and 18% of jail inmates (over 400,000 inmates) have spent time in solitary in the past 12 months (Beck 2015). There is consistent evidence that exposure to solitary confinement, especially long-term stays, is associated with risks of self-harm and lasting psychological harm, including anger, aggression, anxiety, depression, hypersensitivity to external stimuli, and even psychosis (Arrigo and Bullock 2007; Grassian 1983; Haney 2003a, 2012; Kaba et al. 2014; Lanes 2009; Rhodes 2004; Smith 2006). Moreover, adaptations to life in such restrictive and extreme conditions can further complicate the process of reintegrating into society after release.

While the primary justification for the use of solitary confinement is to segregate individuals who are deemed dangerous or incorrigible in order to ensure the safety of other individuals and to maintain institutional order (Frost and Monteiro 2016; Pizarro and Narag 2008; Smith 2006), whether there are disparities net of factors predictive of behavioral risk require more investigation. This study explicitly considers whether exposure to solitary confinement is patterned by key social statuses – namely, race, history of mental illness, and age – net of factors that are predictive of security risk, including statistical risk instruments used by correctional staff. It also considers interactions with race to examine potential compounded disadvantage as well as multiple dimensions of exposure (probability, duration, and frequency of solitary confinement). Furthermore, the study examines different types of isolation (administrative, punitive, temporary, and protective) to further shed light on potential

explanations for observed bias. Findings from this study have important implications for research on inequality and the criminal justice system.

## The Rise of Solitary Confinement

The experiment with solitary confinement in the United States can be traced back to more than 200 years. Some of the earliest use of solitary confinement began in the Walnut Street Jail during the 1790s and later expanded to the Eastern State Penitentiary during the 1820s in Pennsylvania. The practice also developed in New York at the Auburn State Prison in 1821 (Reiter 2012). Penal reformers believed that "silence and solitude would induce repentance and motivate prisoners to live a devout, socially responsible life" (Cloud et al. 2015:19). It was not shortly after that many began to observe that this experiment was far more damaging than reformers had anticipated. The novelist Charles Dickens, on a tour of the Eastern State Penitentiary in 1842, described the practice of solitary confinement as clearly "torture." He remarked that "I believe that very few men are capable of estimating the immense amount of torture and agony which this dreadful punishment, prolonged for years, inflicts upon the sufferers" (quoted in Cooper 2016:348). Similarly, the French political scientist Alexis de Tocqueville, having visited New York's Auburn State Prison, concluded that "[t]his absolute solitude, if nothing interrupts it, is beyond the strength of man; it destroys the criminal without intermission and without pity; it does not reform, it kills" (quoted in Cloud et al. 2015:19). With mounting evidence from the medical field, in 1890 the U.S. Supreme Court in *In re Medley* ultimately concluded that solitary confinement did not lead to reform but instead produced irreparable psychological harm (Reiter 2012). As a result, use of solitary confinement became far more limited shortly after.

As the correctional population dramatically expanded since the 1970s and 1980s, a changing culture and politics of punishment significantly transformed prison life – and set the conditions for the resurrection of solitary confinement. A "culture of control" and "new penology" emphasized punishment and risk management over rehabilitation and reform of prisoners (Feeley and Simon 1992; Garland 2001). As part of this punitive turn, prisons have increasingly become "warehouses" that are designed for containment and exacting retribution and "penal harm" (Cullen 1995; Irwin 2005; Lerman 2013; Lynch 2009). "No-frills" prison initiatives severely reduced or stripped social services, programming, and privileges, such as college education programs, phone calls, exercise equipment (Johnson, Bennett, and Flanagan 1997).[1] Although these measures were implemented as part of a cost-cutting effort, operating isolation units can be double or twice the costs of regular security units due to enhanced security and staffing requirements – not including the cost of construction separate supermax facilities (Shames, Wilcox, and Subramanian 2015).

This shift marked a unique historical moment when the most extreme forms of punishment, which were not previously considered widely acceptable, became normalized (Haney and Lynch 1997). The expanded use of solitary confinement in the 1980s reflects this rise in harsh and aggressive penal policies and practices (Reiter 2017; Rhodes 2004).[2] Renewed interest in solitary confinement grew after the experiment in permanent and complete lockdown at the U.S. Penitentiary in Marion, Illinois following the murders of two correctional agent in 1983 (Richards 2015). Moreover, as the extraordinary expansion of the prison population led to

[1] The protest and uprising at the Attica Correctional Facility in New York and the institutional response exemplify this transformation in penal attitudes and practices (Thompson 2016).

[2] Supermax facilities – prisons that are in permanent lockdown – developed from and dramatically expanded after the experiment on isolation in the U.S. Federal Penitentiary near Marion, Ill in 1983 (Richards 2015).

overcrowding and prison management concerns, greater tolerance for punitive strategies ushered widespread adoption of solitary confinement and construction of maximum-security facilities (Richards 2015). Ironically, research suggests this expansion occurred during a period in which overall prison violence independently *decreased* (Useem and Piehl 2006), suggesting that this growth reflects changes in attitudes toward punishment and a movement toward exacting penal harm (Clear 1994; Cullen 1995; Garland 2001).

The primary purported rationale for use of solitary confinement is to maintain order and manage risk in prisons by isolating prisoners deemed the most incorrigible (Pizarro and Narag 2008; Smith 2006). While policies and practices regarding use of solitary confinement vary by jurisdictions, individuals are isolated for three main reasons: punitive (or disciplinary), administrative, and protective isolation (Baumgartel et al. 2015; Frost and Monteiro 2016; Ghafar 2017). First, punitive isolation is used as a punishment for rules infractions or assaults against other inmates or prison staff. The nature and length of stay is typically determined following a formal misconduct hearing by correctional staff. Second, individuals who may not have committed a specific rule violation but nevertheless are deemed as a serious threat to other inmates, staff, and institutional order may be placed in administrative isolation. This includes individuals who pose a physical safety threat, are affiliated with a gang, are an escape risk, and those who refuse medical screening or treatment for a communicable disease. Third, solitary confinement is used as a protective measure to isolate individuals who are vulnerable to victimization in the general prison population (Frost and Monteiro 2016). Finally, temporary isolation is used for short-term isolation of individuals who have pending misconduct hearings that might result in punitive isolation, assignment to administrative isolation, investigation of the need for protection from the general prison population, or a transfer to another facility.

Today, conditions in solitary units characterized by severe limitations on individuals' mental, physical, and social stimulation for days, months, years, or even indefinitely. Individuals are held in small cells for 22-24 hours a day with little or no opportunity for meaning social contact and engagement, including access to work, educational, and therapeutic programming. Visitation from relatives and friends on the outside are severely restricted. Privileges such as access to reading, radio, and television are also highly restricted, if not denied altogether (Arrigo and Bullock 2007; Frost and Monteiro 2016; Reiter 2017; Smith 2006). Often, environments in these units are also marked by hostility and violence, where individuals may be subjected to lethal use of force and abusive treatment (Arrigo and Bullock 2007; Irwin 2005; Shaylor 1998).

## Theoretical Framework

*Discretion and Punishment*

Research on inequalities in the administration of justice has examined discretion and disparate treatment at key points in the criminal justice process, including policing, prosecution, and sentencing (Abrams et al. 2012; Bushway and Piehl 2001; Kutateladze et al. 2014; Mustard 2001; Selbst 2017; Starr 2015; Steffensmeier and Demuth 2000; Steffensmeier et al. 1998; Stolzenberg, D'Alessio, and Eitle 2013; Ulmer et al. 2007; Yang 2015). This line of research focuses on the decision-making of criminal justice actors and its susceptibility to bias. Decisions at the sentencing stage, in particular, have received much attention given the severity of potential outcomes, including imprisonment (Baumer 2013; Mitchell 2005). Studies draw on the focal concerns framework to explain the relevance of legal *and* extralegal factors in the sentencing process (Steffensmeier and Demuth 2000; Steffensmeier et al. 1998).

The focal concerns framework suggests three primary concerns that influence judicial decisions: (1) blameworthiness, (2) protection of the community, and (3) practical constraints

and consequences (Steffensmeier et al. 1998). Blameworthiness focuses on defendants' culpability, the seriousness of the crime, and prior criminal history. Protection of the community focuses on the potential threat to the community and centers on assessing potential future criminal behavior. Lastly, practical constraints and consequences consider the ability of defendants to serve the sentence, the costs of punishment to the correctional system, and the impact on the court's standing and judges' reputation (Steffensmeier and Demuth 2000; Warren, Chiricos, and Bales 2012). In principle, judges rely on the merits of the crime and criminal history to assess these focal concerns; however, in practice, often incomplete information means that in order to reduce uncertainty, judges may rely on defendants' social statuses, such race, age, socioeconomic status, and gender, to assess blameworthiness and dangerousness (Kutateladze et al. 2014; Steffensmeier and Demuth 2000). Furthermore, use of perceptual shorthand, which may be influenced by stereotypes, in turn leads to biased decisions.

There are reasons to suspect that the process of managing uncertainty and resulting disparate treatment may extend beyond criminal sentencing to other decision-making points in the criminal justice system, including in-prison sanctions like solitary confinement (Butler and Steiner 2017; Cochran et al. 2017; Steffensmeier and Demuth 2000). First, prison staff wield considerable discretion in imposing the type and severity of in-prison sanctions. This includes placement and duration of time in solitary confinement. In response to misconduct or violating behavior, staff have discretion to place individuals in punitive isolation. Individuals who pose an institutional risk may be placed in administrative isolation even without having committing a specific offense. Second, the demands of managing large inmate population and need to resolve potential security risks expediently may lead to greater reliance on perceptual shorthand rather than the merits of violating behavior and individual conduct history. Third, in-prison disciplinary

rules are numerous and often ambiguous, and thus susceptible to uneven enforcement (Armstrong 2015). Finally, the potential for disparate treatment may be even greater because "prisons are closed institutions with little public oversight or transparency" (Armstrong 2015:750; Poole and Regoli 1980).

Prior research suggests several key social statuses and characteristics that are salient in the assessment of focal concerns in the prison context. Race, age, and history of mental illness are all associated with perception of threats and institutional risks. Below, I discuss each in more detail.

*Race*

A large body of work has examined the role of race in influencing enforcement and punishment decisions throughout the criminal justice process. Research shows that minorities, and blacks in particular, are disproportionately stopped by the police, arrested, prosecuted, convicted, and to some degree sentenced to prison (relative to other sanctions) (Abrams et al. 2012; Alexander 2010; Lerman and Weaver 2014; Starr 2015; Yang 2015). There are a number of reasons to expect that racial disparities may persist in prison settings and with regard to exposure to solitary confinement specifically. First, racial stereotypes or cues increase the likelihood that minorities are perceived as a threat or problem (Young 2018), especially in the context of ambiguous rules and enforcement (Armstrong 2015:770). Second, greater scrutiny of minorities, as a result of perception of threat, increases greater likelihood of detecting and reporting of misconducts and infractions (Poole and Regoli 1980). Indeed, Poole and Regoli (1980) show that black and white inmates are equally likely to commit prison rule infractions, yet blacks are more likely to be formally written up for a rule violation. The accumulation of infractions, in turn, increases the risk of being placed in solitary. Third, the practice of using

gang membership as a justification for solitary may result in higher rates of placement in solitary among minorities, particularly blacks and Latinos, because they are more likely to be perceived as gang members (Haney and Lynch 1997; Kupers 1999). Fourth, use of seemingly objective statistical risk assessments to evaluate potential institutional security threats and determine cell assignment (including solitary confinement) may lead to disparities in solitary placement. While risk assessments do not expressly include race as a predictor, they do incorporate factors highly correlated with race, such as prior criminal history and prior prison infractions – that are potentially products of past disparate treatment. As shown in other contexts, the net effect of using statistical risk assessments is disproportionate representation of minorities in harsher sanctions (Harcourt 2007; Lerman 2013; Starr 2014). Finally, research on cumulative disadvantage suggests that race differences in punishment decisions may be modest or non-significant at later stages of the criminal justice system (due to populations being more selective at each successive stage), including in-prison sanctions. However, minorities still face disproportionate exposure given their higher rates of imprisonment (Alexander 2010), longer prison sentences (Bushway and Piehl 2001; Mustard 2001; Yang 2015), and greater risk of having infractions detected and reported (Poole and Regoli 1980).

*Mental Illness*

Prisons draw a disproportionate number of individuals with mental illness, many of whom suffer from undiagnosed psychiatric disorders (Fellner 2006; Prins 2014; Smith 2006). Moreover, prisons often have scarce mental health resources to adequately treat such problems. Behavioral problems that are symptoms of mental illness, in turn, increase propensity for accumulating infractions and ultimately risk of solitary confinement. Individuals with mental illness may have more difficulty adjusting to the rigid structure prison life, including numerous

rules and regulation. Refusal to comply with orders, disruptive behavior, and aggression and violent outbursts may lead to infractions and risk of disciplinary action like solitary (Abramsky and Fellner 2003; Arrigo and Bullock 2007). Infractions notwithstanding, the unpredictability and stigma of serious mental illness and practical constraints of scarce psychiatric resources may lead staff to evaluate individuals with mental illness as a potential institutional security risk (Hartwell 2004). Prior research, indeed, suggests a strong stereotype of dangerousness associated with mental illness (Link et al. 1999). As a consequence, such individuals may be placed in isolation (administrative segregation) as a preventative measure. Once there, insufficient mental health resources coupled with psychological deterioration associated with isolation can aggravate pre-existing illnesses (Arrigo and Bullock 2007; Haney 2003a; Kupers 1999; Smith 2006). Destructive "acting out" behaviors, such as damaging property and assaulting staff, as a response to the stresses of isolation can enhanced perceptions of potential threats to the general prison population and ultimately prolong stays in solitary (Fellner 2006; Toch and Adams 2002).

*Age*

Age may also be an important factor in evaluating focal concerns. Prior research on sentencing suggests a curvilinear relationship between age and incarceration, where punishment increases to age 30 and decline precipitously afterwards (Steffensmeier, Kramer, and Ulmer 1995; Steffensmeier et al. 1998). This relationship may translate to prison contexts in several ways. On the one hand, if prison staff assess disciplinary infractions committed by the youngest and oldest individuals as less harmful there may be elevated risks for individuals in their 20s and 30s. In terms of practical constraints, correctional staff may deem the youngest and oldest inmates as less able to endure the experience of solitary confinement, thereby reducing their exposure. On the other hand, research also suggests that the youngest individuals (especially

minorities) are more likely to be perceived as threatening and more likely to engage in future misconduct (Warren et al. 2012). This suggests instead a greater likelihood of placement in solitary confinement for the youngest individuals.

*Race Interactions*

Combinations of social statuses may compound the risk of exposure to solitary confinement. Research specifically suggests the enduring significance of race as a "master status" that exert the strongest influence on outcomes, especially with regard to experiences of punishment (Feagin 1991; Steffensmeier et al. 1998). Minority status, therefore, amplifies the risk of exposure to harsher punishment for already high-risk social statuses. In the context of prisons, race interactions with mental illness history and age are especially important. Perceptions of minorities as threatening can interact with the stigma of mental illness to elevate the risk of exposure to solitary confinement (Eitle, D'Alessio, and Stolzenberg 2002; Link et al. 1999). Moreover, prior research indicates that young minorities individuals are most likely to be viewed as dangerous and blameworthy, suggesting that young minority individuals may be more likely to experience solitary confinement (Steffensmeier et al. 1998; Warren et al. 2012). In brief, intersecting and negatively perceived social statuses magnify perceptions of threat, and as a consequence, heighten disparities in exposure to solitary confinement.

*Vulnerable Statuses*

Another justification for the use of solitary confinement is protection of individuals vulnerable to victimization in the general prison population. As a result, social statuses indicative of vulnerability may lead to increased exposure for reasons that are distinct from an assessment of focal concerns. Research identifies three key such statuses: having a mental illness, juveniles,

and non-heterosexual.[3] First, individuals with mental illness are especially at risk of abuse by other inmates. They may have difficulty adapting to the code of conduct in prison, including both formal and informal (such as social expectations regarding snitching). Moreover, social impairment associated with serious mental illness may increase susceptibility to manipulation and sexual abuse by others (Abramsky and Fellner 2003; Beck et al. 2013; Wolff, Blitz, and Shi 2007). Second, juveniles who are housed in adult facilities are also be vulnerable to victimization (Man and Cronan 2002; Steiner et al. 2017). Third, studies consistently have shown that individuals who are non-heterosexual (lesbian, gay, bisexual, and transgender) and non-gender conforming are particularly at high risk of sexual assault, especially in the context of hyper-masculinity in prisons (Beck et al. 2013; Hensley, Tewksbury, and Castle 2003; Man and Cronan 2002). Together, these statuses may increase propensity into protective isolation.

*Summary of expectations*

Based on theory and prior research, it is possible to generate a number of expectations regarding social statuses and the risk of exposure to solitary confinement. Given competing motivations for the use of solitary – protection *of* the prison population and protection *from* the prison population – it is important to also specify the specific type of confinement. Administrative and punitive isolation are intended for protection *of* the prison population, while protective isolation is employed for protection *from* the general prison population. Temporary isolation can be utilized for both. First, across multiple dimensions of exposure (probability, duration, and frequency of solitary confinement), race, age, and history of mental illness are expected to predict exposure to administrative, punitive, and temporary isolation, net of criminal

[3] Individuals who are sentenced for a sexual violence crime or renounce gang membership have also been shown to be at-risk of victimization (Mears 2016).

justice relevant factors, including statistical assessments of risk. Second, significant interactive effects are additionally expected for the combinations of race and history of mental illness, and of race and age. Third, vulnerable statuses – history of mental illness, age, and known homosexual – are anticipated to increase exposure to temporary and protective isolation.

## Data and Methods

This study draws on administrative records from the Michigan Department of Corrections (MDOC) on all individuals convicted of a new felony and sentenced between January 1, 2003 to December 31, 2006 and followed through the end of 2013 (N=140,267). The final cohort consists of all individuals who were sentenced to prison during the four-year baseline period or at any point during follow up (N=46,513).

*Outcomes*

The study focuses on three dimensions of exposure to solitary confinement as the outcomes of interest: probability, duration, and frequency of solitary confinement. Exposure is defined as placement in a segregation unit for any reason – administrative, punitive, temporary, and protective – for at least one day (N=15,965) at any point during the observation period. The duration of exposure is the number of days pooled across all trips to solitary confinement during the observation period. Movements in the correctional system were drawn from MDOC administrative databases, including type of cell assignment (general prison population, administrative segregation, punitive segregation, temporary segregation, and protective segregation), dates of movements, and subsequent prison admissions.

*Covariates*

Information on baseline factors and prison cell movements were draw from Pre-Sentence Information (PSI) reports and MDOC's databases. Demographic characteristics include race (non-white, white), age at sentencing (14-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51+), gender, marital status (single, non-single), known homosexual, and educational attainment (less than high school, GED equivalent, high school, and more than high school). Self-reported health measures include history of mental illness, physical disability, health insurance, body mass index (BMI) calculated from height and weight (underweight, normal, overweight, and obese), and substance use history (alcohol, marijuana, stimulants, opioids, and other drugs). The PSI reports also provided data on criminal history, including prior felony convictions and the number of prior adult jail, prison, and probation commitments. Prior number of arrests (0-4, 5-9, and 10 or more) were drawn the Michigan State Police. Statistical risk assessments of assaultive risk and property damage were extracted from the MDOC databases. Assaultive risk (low, middle, and high) is scored based on the type of crime individuals are sentenced (i.e., robbery, sexual assault, murder, or any assaultive felony), first arrest before the age of 15, prior serious institutional misconduct in prison, reported history of juvenile felony, and whether individuals were ever married. Property risk (low, middle, and high) is based on reported history of juvenile history, prior serious institutional misconduct in prison, first arrest before the age of 15, and history of drug abuse. Information on the focal sentence (the original sentence that entered individuals into the study between 2003 and 2006) include the type of sentence (jail, jail and probation, prison, and probation), the type of crime (controlled substance, violent, property, public order, and public safety) and total offense severity score based on the sentencing guidelines. Summary statistics of covariates for the overall sample and by each type of isolation are reported in Supplemental Tables A-S1 and A-S2.

The analysis was conducted using methods appropriate for each outcome of interest. Multivariate logistic regression was employed to model the probability of solitary confinement, linear regression to model cumulative days spent in solitary confinement, and Poisson regression to estimate the number of trips to solitary confinement. All models condition on the set of covariates described above, including criminal history and statistical risk assessments – important predictors of potential violent behavioral risk and threats to the institution. Models also include county and sentencing year fixed effects. Robust standard errors are reported for all estimates.

## Results

*Summary Statistics of Exposures*

Table A-1 reports summary statistics of the proportion of the sample with exposure to solitary confinement, the cumulative days spent in solitary, and the frequency of trips to solitary for the overall sample and for the subsample with any exposure to solitary confinement. The table also reports summaries of means for any form of isolation and by each type. For the overall sample, 34% of the sample experienced any form of solitary confinement during the observation period. Nineteen percent experienced administrative isolation, while 15% experienced punitive, 24% temporary, and 3% protective isolation.[4] Among those with any exposure to solitary, 56% were in administrative isolation, 42% punitive, 71% temporary, and 8% protective. In terms of the cumulative days in solitary, the average for the overall is 47 days for all solitary stays, 30 for administrative, 6 for punitive, 7 for temporary, and 5 for protective isolation. Among those with any exposure, the average overall is 137 days for all solitary stays, 86 for administrative, 18 for

[4] Proportions are not mutually exclusive. Individuals can (and do) experience multiple forms of isolation.

punitive, 19 for temporary, and 14 for protective isolation. Finally, the average number of trips to solitary is 2 for the overall sample, while the average is 6 for those with any exposure. Overall, these summary statistics indicate that solitary confinement is not a rare experience, nor it is a brief or infrequent one.

*[Table A-1 about here]*

*Probability of Exposure*

Table A-2 presents results from logistic regressions that predict the probability of any solitary confinement and separately for each type of confinement: administrative, punitive, temporary, and protective. Results show that key criminal justice factors are significantly associated with increased odds of placement in solitary confinement for any reason and by each type of confinement. This is consistent with the expectation that solitary confinement is targeted toward dangerous and violent individuals. Prior arrests, prior felony convictions, prior adult jail commitments, and prior adult prison commitments are all significantly associated with increased odds of any solitary confinement stay, while prior arrests and adult jail commitments are significant predictors for all types of confinement except for protective confinement. Prior misconducts in prison, including those for violent offenses, contraband, and disobedience, are significantly associated with any solitary confinement stay and all types of confinement. For example, individuals who had a violent misconduct had about 1.7 times the odds of solitary confinement, compared to those who do not. Results also indicate the more time individuals spend in prison, the greater the risk of solitary.

*[Table A-2 about here]*

In addition to criminal history, statistical risk assessments of assault and property destruction are also expected to predict placement in solitary. Results show that risk scores for assault risk are significantly associated with greater odds overall and across each type of confinement. Notably, individuals designated as "high assault risk" have approximately 2.4 times the odds of solitary confinement of any type compared to those designated as "low assault risk." Risk for property damage, while smaller in size, is also predictive of the odds of solitary confinement overall and across each type, except for protective confinement (where it is positive but not significant). Together, these results confirm expectations that individuals with more criminal history and those considered "high risk" based on statistical assessments have greater risk of placement in solitary confinement. In a supplemental analysis, I explore the relationship between race and predicted statistical risk assessments. Results reported in Supplemental Table A-S3 suggestions that net of criminal justice relevant factors, race is correlated with higher assessments of assaultive risk.

The motivation for this study is to investigate disparities in exposure to solitary confinement net of criminal justice factors (discussed above). I now turn to discussing extra-criminal justice social statuses and risk of solitary confinement, focusing on race, history of mental illness, and age. First, results show significant differences in exposure by social statuses. While race is not significantly associated with increased odds of solitary confinement overall, it is weakly associated with increased risk for administrative confinement. This is consistent with the argument that use of (perceived) gang membership as a criteria for placement in administrative segregation disproportionately targets minorities individuals (Frost and Monteiro 2016). Baseline age is negatively associated with the odds of solitary, where the youngest individuals are at most risk overall and across all types of confinement. Compared to individuals

who are 31-35 in age, those who are 14-20 have 2.7 times the odds of any solitary. This overall elevated risk for the youngest group is not entirely driven by greater odds of protective confinement, as the argument that segregation of juveniles mitigates the risk of potential victimization in the general prison population suggests. Rather results suggest that younger individuals, net of criminal justice factors, have high risk of placement in administrative, punitive, and temporary isolation. Individuals who are known homosexuals have elevated risk of solitary confinement for any reason and each type of confinement, except for protective custody. This finding runs contrary to the argument that solitary confinement is used to protect homosexuals and gender non-conforming individuals.[5]

Given the stigma of mental illness and concerns about the mental health consequences of solitary confinement, the risk of exposure for individuals with a history of mental illness is also of particular interest. Results show that having a history of mental illness at baseline is significantly associated with increased odds of solitary for any reason and across all types of confinement, and not just protective isolation. This finding is consistent with expectations that solitary units increasingly house individuals with mental illness (Abramsky and Fellner 2003; Haney 2003a). Taken together, results indicate significant disparities by age and history of mental illness with regard to the probability of administrative, punitive, temporary, and protective isolation – net of key criminal justice relevant factors, including statistical risk assessments. Race is significantly associated only with administrative isolation. This is consistent with prior work showing that minorities are more likely to be perceived as gang members, which is a justification for administrative isolation (Haney and Lynch 1997; Kupers

[5] Results also indicate that women have lower risk of punitive and protective isolation, but higher risk of administrative isolation. Research indicates solitary confinement is used to house pregnant or nursing women (ACLU 2014b); moreover, women are more likely to be placed in solitary for minor infractions relative to men (Shaylor 1998).

1999). The probability of solitary confinement represents one dimension of exposure. Next, I turn to examining cumulative length of time spent in solitary confinement and frequency of trips.

*Cumulative and Frequency of Exposure*

Table A-3 reports results from linear regression models of cumulative time in solitary confinement, overall and by type of confinement. With regard to social statuses, results indicate that non-whites spend on average 14 more days in solitary confinement overall relative to whites. This overall estimate is largely driven by longer stays in administrative confinement (16 days on average). Notably, non-whites spend on average 4 days *fewer* in protective confinement. While non-whites are no more or less likely to be placed in solitary confinement overall (as shown in Table 2), once in solitary units they spend more time there on average. Estimates by age similarly reflect patterns found in the results for the probability of solitary – that is, the youngest individuals spend on average more time in solitary confinement of all types. Individuals who are 14-20 spend on average 57 days overall in solitary; this finding, too, appears to be driven largely by stays in administrative isolation (39 days on average). Results also show that known homosexuals also spend on average 35 more days in solitary, and this is driven by time in administrative confinement, and not protective isolation. Finally, individuals with a history of mental illness also spend significantly more time in isolation on average (22 days), and they spend the most time in administrative isolation – and not protective isolation.[6]

*[Table A- 3 about here]*

[6] Results also show that women, while more likely to experience solitary confinement overall, spend less time on average once there (about 14 days fewer); however, they appear to spend slightly more time in temporary isolation (3 days more on average).

Second, compared to models of the probability of solitary confinement, results show that criminal history is generally less predictive of cumulative length of exposure, with adult jail commitment being the exception. This suggests that while criminal history determines the probability of solitary confinement, it is less important for influencing the duration of time spent there. Prior in-prison misconducts remain strong positive predictors. Individuals with a prior violent misconduct, on average, spend 32 days in solitary compared to those who do not. Similarly, assault risk assessments are also predictive. Individuals determined as "high assault risk" spend on average about 64 days more in solitary confinement for any reason, compared to those considered "low assault risk." Estimates are also larger for administrative confinement, reflecting on average longer stays. Recall that individuals placed in administrative do not necessarily have time-limited stays – they may be held there indefinitely.

Finally, Table A-4 reports results from Poisson models estimating the number of trips to solitary. Results are consistent with other dimensions of exposure. One notable exception is the estimate for non-whites, which is now weakly significant for the number of solitary stays for any reason and significant for the number of stays in administrative isolation. Non-white individuals also appear to spend fewer trips to protective isolation. The youngest individuals and those with a history of mental illness are also at greater risk of more stays. Overall, results for the probability, duration, and frequency of solitary confinement indicate the presence of disparities in exposure based on key social statuses.

*[Table A-4 about here]*

*Race Interactions*

Thus far, models assume independent effects of social statuses. As theory suggests, there may be important interactive effects, where multiple statuses can compound the risks of exposure

to solitary confinement. In this following analysis, I focus on two sets of interactions, one between race and mental illness history and the other between race and age. Table A-5 reports results from models that test these interactive effects for the probability of solitary confinement. Each set of interactions is estimated from a separate model. First, results show that non-whites who have a history of mental illness are doubly at risk of exposure to solitary confinement. This is driven by increased risk in punitive and temporary confinement, suggesting greater use of solitary confinement in response to infractions. Recall that individuals may be placed in temporary isolation for a pending misconduct hearing. Second, non-whites who are among the youngest individuals are most likely to be at risk of solitary confinement. For example, non-whites who are 14-20 at sentencing have 2 times the odds of isolation for any reason, and for all types of isolation, except protective isolation. Effects diminish with age.

*[Table A-5 about here]*

Table A-6 reports estimates of interactive effects for the cumulative number of days spent in solitary confinement. Results are generally consistent with those reported in Table A-5. Non-whites with a history of mental illness spent on average 16 more days in any form of solitary confinement, 12 more days in administrative, 3 more days in punitive, and 2 more days in temporary isolation. There is not statistical difference for protective isolation. With regard to the interaction between non-white and age, non-whites who are among the youngest (14-20) experienced much longer stays on average (43 on average for any form of isolation); here, too, overall results are largely driven by stays in administrative isolation. In fact, for the youngest group, they spend less time in protective isolation (4 days fewer). Table 7 reports estimates of interactive effects for the count of trips to isolation. Results are generally consistent with those

reported in Tables A-5 and A-6. Together, these results suggest that minorities who are young and have prior mental illness history face greater risks of exposure to solitary confinement.

*[Table 6 about here]*

*[Table 7 about here]*

## Conclusion

This study empirically evaluates the conventional belief that solitary confinement is deployed to manage the "worst of the worst" individuals in prison – those who pose significant threats to staff or other individuals in prison or to institutional order more broadly. The study contributes to the literature by examining multiple dimensions of exposure and forms of isolation and accounting for a robust set of potential confounders. Controlling for criminal justice relevant factors that are associated with such risk, including statistical assessments used by prison staff to evaluate assault risk, this study finds evidence of disparities in exposure to solitary confinement by social statuses – namely by race, history of mental illness, and age. Specifically, the study offers several key findings: First, being non-white is associated with increased risk of placement in administrative isolation, spend on average more time in any form of isolation, and are more likely to have more frequent trips to isolation. Second, a history of mental illness is consistently associated with placement, duration, and frequency of solitary confinement; and this relationship reflects increased exposure to all forms of isolation, including administrative and punitive, and not just protective isolation. Third, the youngest individuals are most at risk across all dimensions of exposure. Finally, being non-white amplifies the risk of exposure for individuals with a history of mental illness and for the youngest individuals. Together, these findings suggest that conventional belief about the intended use of solitary confinement may not ring entirely true. Solitary confinement does not simply concentrate the "worst of the worst"; it draws some of the

most vulnerable individuals. The burden of highly punitive sanctions like solitary confinement is not evenly distributed. Perceptions and stereotypes of risk and danger associated with such social statuses appear to influence punishment decisions.

Evidence of racial disparities in treatment at the prison stage concords with research focused on earlier stages of the criminal justice process (Abrams et al. 2012; Alexander 2010; Lerman and Weaver 2014; Starr 2015; Yang 2015). Interactive effects of race, moreover, underscore the enduring significance of race as a "master status" that influences the type and severity of sanctions and punishments in the criminal justice system. While this study offers modest evidence of racial differences in the probability of solitary confinement, on the whole racial disparities may be even more pronounced because minorities are over-represented in the prison population, and thus, have greater exposure to the risk of solitary confinement. While much attention has been devoted to the racialized growth of mass incarceration (e.g., Alexander 2010; Pettit 2012; Western 2006), this study further suggests that some of the harshest and potentially most damaging forms of punishment as part of the prison boom are directed at racial minority individuals.

The fact that individuals with a history of mental illness are at greater risk of exposure to solitary confinement is not entirely surprising given research on the concentration of these individuals in prison and limited resources in prison to treat psychiatric disorders. Untreated illnesses may manifest in behavioral problems that lead to infractions as well as confirm the stereotype of dangerousness associated with mental illness (Fellner 2006; Link et al. 1999). The over-representation of individuals with mental illness in solitary units is troubling because of established lasting negative impacts of solitary on mental health, including depression, anxiety, hypersensitivity to external stimuli, and more serious disorders such as psychosis (Arrigo and

Bullock 2007; Haney 2003b; Kupers 1999). Placing individuals with serious mental illness in isolation could lead to fatal consequences, as research has shown that individuals held in solitary confinement are at higher risk of self-harm and suicide (Cloud et al. 2015; Kaba et al. 2014; Kupers 1999). In brief, individuals who are likely least equipped to bear the potential damaging effects of social isolation are over-exposed to it.

The disproportionate concentration of juveniles and younger individuals in solitary confinement is equally worrisome. While some states now prohibit the use of punitive isolation for juveniles, many still allow its use for administrative and protective isolation (Cooper 2016). The American Medical Association has determined that solitary confinement is particularly harmful for juvenile because they are more vulnerable to its deleterious consequences, including greater risk of self-harm and suicide (Cloud et al. 2015; Moran 2014). It concluded that "solitary confinement of juveniles in correctional settings is detrimental to adolescent health and should be prohibited, except for extraordinary circumstances" (Moran 2014).

Findings indicate that vulnerable groups, such as known homosexuals, who are likely at high risk for victimization, are not necessarily more likely to be placed in protective isolation. Instead, they are more likely to be placed in administrative, punitive, and temporary isolation. There are several possible explanations for this finding. Placement in protective housing may be subjected to limited availability, and correctional facilities may prioritize the isolation of individuals who are deemed serious security threats to the institutional. It is also possible that individuals may purposively engage in infractions and misconducts with the aim of placement in solitary. Indeed, qualitative research suggests some individuals view solitary confinement as a temporary reprieve and place of solace from the dangers and chaos of the general prison population (Valera and Kates-Benman 2016). This, however, points to broader problems about

the safety of prisons. Moreover, while isolating individuals for their protection may be justifiable in principle, the deleterious impacts of any exposure, regardless of intent, raise serious concerns.

This study has several limitations. First, while the study can account for a robust set of criminal justice relevant factors that are predictive of potential behavioral risk and danger – including statistical assessments used by the prison staff – there may be potential unobserved confounding (such as gang membership) that could influence estimates. Second, the study can only account for prior in-prison infractions, not necessarily the specific infraction that resulted in isolation in the case of punitive isolation, nor the particular reason for administrative isolation. Third, the study was conducted in one state. Policies and practices of solitary confinement may vary widely across jurisdictions, and as such, findings from this study may not be generalizable. Fourth, the study draws on data from adult correctional facilities. It cannot speak to patterns of exposure in juvenile facilities. Finally, the sample includes isolation experiences only in prison settings and not jail, which may have importance differences and warrants further investigation (Haney et al. 2016).

The need to ensure the safety of individuals and to maintain institutional security are of course legitimate concerns. Use of solitary confinement, however, has not been demonstrated to reliably and appreciably reduce subsequent infractions nor assaults against staff (Briggs et al. 2003; Labrecque 2015; Lucas and Jones 2017; Morris 2016). Instead, it may be counterproductive by promoting aggression and violence and increasing tension and violence between individuals held in solitary units and staff (Irwin 2005; Toch and Adams 2002). Moreover, the majority of individuals, including those held in solitary units, are eventually released back to society. In the long run, such experiences may leave individuals irreparably harm and aggravate the challenges associated with the transition back to society. It is thus critical

to reevaluate the use of this practice and develop alternative measures to protect the safety of individuals held in prison as well as those who work there.

## Tables

Table A-1. Summary Statistics of Exposure Variables

| | Full Sample | | Any Solitary Confinement | |
|---|---|---|---|---|
| | Mean / % | SD | Mean / % | SD |
| *Proportion of Sample in Solitary Confinement* | | | | |
| Any Solitary Confinement | 0.34 | 0.47 | - | - |
| Administrative Isolation | 0.19 | 0.39 | 0.56 | 0.50 |
| Punitive Isolation | 0.15 | 0.35 | 0.42 | 0.49 |
| Temporary Isolation | 0.24 | 0.43 | 0.71 | 0.45 |
| Protective Isolation | 0.03 | 0.17 | 0.08 | 0.28 |
| *Cumulative Days in Solitary Confinement* | | | | |
| All Solitary Confinements | 46.97 | 190.51 | 136.85 | 305.68 |
| Administrative Isolation | 29.52 | 146.42 | 85.99 | 240.01 |
| Punitive Isolation | 6.23 | 32.01 | 18.15 | 52.63 |
| Temporary Isolation | 6.51 | 23.43 | 18.97 | 36.93 |
| Protective Isolation | 4.72 | 55.05 | 13.75 | 93.29 |
| *Number of Trips to Solitary Confinement* | | | | |
| All Solitary Confinements | 2.09 | 5.99 | 6.08 | 8.95 |
| Administrative Isolation | 0.88 | 3.41 | 2.58 | 5.43 |
| Punitive Isolation | 0.40 | 1.44 | 1.18 | 2.26 |
| Temporary Isolation | 0.72 | 1.99 | 2.09 | 2.94 |
| Protective Isolation | 0.08 | 0.67 | 0.23 | 1.14 |
| Observations | 46,513 | | 15,965 (34.3%) | |

Table A-2. Probability of Solitary Confinement, By Confinement Type

| | Any Solitary Confinement | | Administrative | | Punitive | | Temporary | | Protective | |
|---|---|---|---|---|---|---|---|---|---|---|
| | coef. | odds ratio | coef. | odds ratio | coef. | odds ratio | coef. | odds ratio | coef. | odds ratio |
| *Demographic Characteristics* | | | | | | | | | | |
| Non-White | 0.028 | 1.028 | 0.081* | 1.084* | 0.047 | 1.048 | 0.028 | 1.028 | 0.137 | 1.146 |
| | (0.027) | (0.028) | (0.033) | (0.035) | (0.037) | (0.039) | (0.030) | (0.031) | (0.079) | (0.090) |
| Female | 0.600*** | 1.823*** | 0.963*** | 2.619*** | -4.504*** | 0.011*** | 0.042 | 1.043 | -3.867*** | 0.021*** |
| | (0.046) | (0.084) | (0.054) | (0.141) | (0.504) | (0.006) | (0.053) | (0.056) | (1.005) | (0.021) |
| Age at Sentence | | | | | | | | | | |
| 14-20 (ref: 31-35) | 0.998*** | 2.712*** | 1.075*** | 2.930*** | 1.287*** | 3.623*** | 0.899*** | 2.457*** | 1.203*** | 3.331*** |
| | (0.050) | (0.135) | (0.060) | (0.175) | (0.070) | (0.253) | (0.054) | (0.133) | (0.143) | (0.477) |
| 21-25 | 0.629*** | 1.875*** | 0.618*** | 1.856*** | 0.811*** | 2.250*** | 0.590*** | 1.805*** | 0.921*** | 2.511*** |
| | (0.043) | (0.081) | (0.053) | (0.098) | (0.062) | (0.140) | (0.048) | (0.086) | (0.128) | (0.320) |
| 26-30 | 0.254*** | 1.289*** | 0.246*** | 1.279*** | 0.427*** | 1.533*** | 0.243*** | 1.276*** | 0.417** | 1.517** |
| | (0.043) | (0.056) | (0.053) | (0.068) | (0.063) | (0.096) | (0.048) | (0.061) | (0.130) | (0.198) |
| 36-40 | -0.141** | 0.868** | -0.164** | 0.849** | -0.115 | 0.891 | -0.196*** | 0.822*** | -0.053 | 0.948 |
| | (0.046) | (0.040) | (0.057) | (0.048) | (0.069) | (0.061) | (0.052) | (0.042) | (0.141) | (0.133) |
| 41-45 | -0.315*** | 0.730*** | -0.282*** | 0.754*** | -0.309*** | 0.734*** | -0.333*** | 0.717*** | -0.291 | 0.748 |
| | (0.051) | (0.037) | (0.063) | (0.048) | (0.077) | (0.057) | (0.057) | (0.041) | (0.166) | (0.124) |
| 46-50 | -0.458*** | 0.633*** | -0.487*** | 0.615*** | -0.449*** | 0.638*** | -0.479*** | 0.620*** | -0.645** | 0.525** |
| | (0.061) | (0.039) | (0.079) | (0.049) | (0.095) | (0.061) | (0.069) | (0.043) | (0.221) | (0.116) |
| 51+ | -0.720*** | 0.487*** | -0.629*** | 0.533*** | -0.778*** | 0.459*** | -0.767*** | 0.464*** | -0.680** | 0.506** |
| | (0.073) | (0.036) | (0.094) | (0.050) | (0.119) | (0.055) | (0.087) | (0.040) | (0.252) | (0.128) |
| Known Homosexual | 0.387** | 1.472** | 0.382* | 1.466* | 0.570*** | 1.768*** | 0.443** | 1.557** | 0.482 | 1.619 |
| | (0.136) | (0.200) | (0.157) | (0.230) | (0.167) | (0.295) | (0.137) | (0.214) | (0.303) | (0.491) |
| *Human Capital* | | | | | | | | | | |
| Pre-Sentence Employment | -0.009*** | 0.991*** | -0.009*** | 0.991*** | -0.011*** | 0.989*** | -0.009*** | 0.991*** | -0.012*** | 0.988*** |
| | (0.000) | (0.000) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) |
| *Health and Substance Use History* | | | | | | | | | | |
| Mental Illness History | 0.360*** | 1.433*** | 0.382*** | 1.465*** | 0.462*** | 1.587*** | 0.393*** | 1.481*** | 0.276*** | 1.318*** |
| | (0.029) | (0.042) | (0.034) | (0.050) | (0.038) | (0.061) | (0.031) | (0.047) | (0.081) | (0.106) |
| Any Use of Marijuana | -0.015 | 0.985 | -0.035 | 0.965 | 0.039 | 1.040 | -0.001 | 0.999 | -0.085 | 0.918 |
| | (0.029) | (0.028) | (0.035) | (0.033) | (0.040) | (0.042) | (0.032) | (0.032) | (0.082) | (0.075) |
| Any Use of Stimulants | 0.038 | 1.038 | 0.002 | 1.002 | 0.068 | 1.070 | 0.062* | 1.064* | -0.086 | 0.918 |
| | (0.028) | (0.029) | (0.033) | (0.033) | (0.038) | (0.041) | (0.030) | (0.032) | (0.077) | (0.071) |
| Any Use of Opioids | 0.023 | 1.024 | -0.002 | 0.998 | 0.012 | 1.012 | 0.042 | 1.043 | -0.034 | 0.967 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (0.034) | (0.035) | (0.041) | (0.041) | (0.048) | (0.048) | (0.037) | (0.039) | (0.104) | (0.100) |
| Self-Reported Physical Disability | 0.066** | 1.068** | 0.084** | 1.088** | 0.051 | 1.052 | 0.066* | 1.068* | -0.033 | 0.968 |
| | (0.025) | (0.026) | (0.030) | (0.032) | (0.034) | (0.035) | (0.027) | (0.029) | (0.070) | (0.068) |
| *Criminal History* | | | | | | | | | | |
| Prior Felonies | 0.017** | 1.017** | 0.012 | 1.012 | 0.011 | 1.011 | 0.016** | 1.016** | -0.003 | 0.997 |
| | (0.006) | (0.006) | (0.007) | (0.007) | (0.008) | (0.008) | (0.006) | (0.006) | (0.015) | (0.015) |
| 5-9 Prior Arrests | 0.083** | 1.087** | 0.090* | 1.095* | 0.039 | 1.040 | 0.083* | 1.086* | 0.096 | 1.100 |
| | (0.030) | (0.033) | (0.036) | (0.039) | (0.040) | (0.042) | (0.033) | (0.035) | (0.081) | (0.089) |
| 10+ Prior Arrests | 0.205*** | 1.227*** | 0.210*** | 1.234*** | 0.183*** | 1.200*** | 0.201*** | 1.223*** | 0.129 | 1.138 |
| | (0.034) | (0.042) | (0.041) | (0.051) | (0.046) | (0.055) | (0.037) | (0.046) | (0.096) | (0.109) |
| Ever Had Violent In-Prison Misconduct | 0.537*** | 1.711*** | 0.500*** | 1.648*** | 0.593*** | 1.809*** | 0.517*** | 1.676*** | 0.508*** | 1.662*** |
| | (0.045) | (0.076) | (0.052) | (0.086) | (0.059) | (0.106) | (0.048) | (0.081) | (0.115) | (0.191) |
| Ever Had Drug In-Prison Misconduct | 0.011 | 1.011 | -0.060 | 0.942 | 0.019 | 1.019 | 0.036 | 1.036 | 0.117 | 1.124 |
| | (0.044) | (0.044) | (0.052) | (0.049) | (0.058) | (0.059) | (0.047) | (0.049) | (0.114) | (0.128) |
| Ever Had Contraband In-Prison Misconduct | 0.266*** | 1.305*** | 0.359*** | 1.432*** | 0.354*** | 1.425*** | 0.284*** | 1.328*** | 0.400*** | 1.492*** |
| | (0.045) | (0.059) | (0.052) | (0.075) | (0.059) | (0.084) | (0.049) | (0.064) | (0.111) | (0.166) |
| Ever Had Disobedience In-Prison Misconduct | 0.419*** | 1.520*** | 0.418*** | 1.519*** | 0.504*** | 1.655*** | 0.474*** | 1.607*** | 0.556*** | 1.744*** |
| | (0.053) | (0.080) | (0.067) | (0.102) | (0.076) | (0.126) | (0.060) | (0.097) | (0.160) | (0.279) |
| *Risk Scores* | | | | | | | | | | |
| Middle Assault Risk (ref: Low Risk) | 0.349*** | 1.417*** | 0.359*** | 1.432*** | 0.386*** | 1.471*** | 0.369*** | 1.447*** | 0.577*** | 1.780*** |
| | (0.030) | (0.042) | (0.037) | (0.053) | (0.041) | (0.060) | (0.033) | (0.047) | (0.092) | (0.164) |
| High Assault Risk | 0.875*** | 2.399*** | 0.700*** | 2.014*** | 0.826*** | 2.284*** | 0.809*** | 2.246*** | 0.539** | 1.715** |
| | (0.079) | (0.190) | (0.083) | (0.168) | (0.087) | (0.200) | (0.078) | (0.175) | (0.172) | (0.295) |
| Middle Property Risk (ref: Low Risk) | 0.091** | 1.095** | 0.065 | 1.067 | 0.026 | 1.026 | 0.075* | 1.078* | 0.075 | 1.077 |
| | (0.029) | (0.032) | (0.036) | (0.038) | (0.041) | (0.042) | (0.033) | (0.035) | (0.084) | (0.090) |
| High Property Risk | 0.242*** | 1.274*** | 0.200*** | 1.222*** | 0.151** | 1.163** | 0.235*** | 1.265*** | 0.099 | 1.104 |
| | (0.038) | (0.049) | (0.044) | (0.054) | (0.049) | (0.057) | (0.041) | (0.051) | (0.096) | (0.106) |
| *Prison Length* | | | | | | | | | | |
| Logged Time in Prison (Months) | 0.642*** | 1.899*** | 0.559*** | 1.750*** | 0.617*** | 1.853*** | 0.513*** | 1.670*** | 0.633*** | 1.884*** |
| | (0.024) | (0.045) | (0.027) | (0.047) | (0.030) | (0.056) | (0.025) | (0.041) | (0.055) | (0.104) |
| Constant | -1.949*** | 0.142*** | -2.767*** | 0.063*** | -3.337*** | 0.036*** | -2.410*** | 0.090*** | -4.955*** | 0.007*** |
| | (0.083) | (0.012) | (0.102) | (0.006) | (0.119) | (0.004) | (0.092) | (0.008) | (0.242) | (0.002) |
| Observations | 43,083 | | 43,083 | | 43,083 | | 43,083 | | 42,828 | |

Note: Selected coefficients shown. Models control for all covariates listed in Supplemental Table A-S1 as well as sentencing year and county fixed effects.
*** p<0.001, ** p<0.01, * p<0.05

Table A-3. Cumulative Days Solitary Confinement (Days), By Confinement Type

| | Any Solitary Confinement | Administrative | Punitive | Temporary | Protective |
|---|---|---|---|---|---|
| | coef. | coef. | coef. | coef. | coef. |
| *Demographic Characteristics* | | | | | |
| Non-White | 14.305*** | 15.899*** | 1.563*** | 0.599* | -3.756*** |
| | (2.096) | (1.591) | (0.370) | (0.265) | (0.686) |
| Female | -13.648*** | -9.587*** | -3.822*** | 2.921*** | -3.160*** |
| | (1.643) | (1.166) | (0.256) | (0.595) | (0.411) |
| Age at Sentence | | | | | |
| 14-20 (ref: 31-35) | 56.810*** | 39.479*** | 6.265*** | 7.211*** | 3.855** |
| | (4.139) | (3.131) | (0.783) | (0.519) | (1.253) |
| 21-25 | 23.106*** | 14.403*** | 1.760** | 3.550*** | 3.393** |
| | (3.116) | (2.322) | (0.602) | (0.415) | (1.057) |
| 26-30 | 8.443** | 4.315* | 0.589 | 0.981** | 2.558* |
| | (2.797) | (2.001) | (0.598) | (0.372) | (1.024) |
| 36-40 | -1.580 | 0.571 | -1.357** | -0.425 | -0.369 |
| | (2.677) | (2.059) | (0.523) | (0.391) | (0.867) |
| 41-45 | -6.105* | -1.669 | -2.121*** | -1.093** | -1.222 |
| | (2.565) | (1.930) | (0.499) | (0.400) | (0.827) |
| 46-50 | -9.560*** | -4.590* | -1.518** | -1.800*** | -1.652 |
| | (2.623) | (1.837) | (0.584) | (0.386) | (0.958) |
| 51+ | -10.484** | -3.904 | -2.232*** | -1.756** | -2.591* |
| | (3.613) | (2.673) | (0.623) | (0.604) | (1.056) |
| Known Homosexual | 35.120* | 20.900* | 4.186 | 5.424* | 4.610 |
| | (15.291) | (10.659) | (3.458) | (2.379) | (4.868) |
| *Human Capital* | | | | | |
| Pre-Sentence Employment | -0.398*** | -0.236*** | -0.055*** | -0.048*** | -0.059*** |
| | (0.026) | (0.019) | (0.004) | (0.004) | (0.009) |
| *Health and Substance Use History* | | | | | |
| Mental Illness History | 22.215*** | 14.055*** | 4.241*** | 3.205*** | 0.716 |
| | (2.608) | (1.904) | (0.531) | (0.352) | (0.799) |
| Any Use of Marijuana | -2.713 | -1.283 | 0.109 | -0.487 | -1.052 |
| | (2.057) | (1.516) | (0.358) | (0.296) | (0.713) |
| Any Use of Stimulants | -1.540 | -1.995 | -0.497 | 0.217 | 0.735 |
| | (1.981) | (1.501) | (0.338) | (0.270) | (0.626) |

| | | | | | |
|---|---|---|---|---|---|
| Any Use of Opioids | -3.637 | -1.380 | -0.773* | -0.314 | -1.170 |
| | (2.099) | (1.539) | (0.324) | (0.309) | (0.750) |
| Self-Reported Physical Disability | -1.419 | -2.048 | -0.210 | 0.621* | 0.217 |
| | (1.851) | (1.392) | (0.320) | (0.248) | (0.604) |
| *Criminal History* | | | | | |
| Prior Felonies | -0.408 | -0.568* | -0.038 | -0.024 | 0.222 |
| | (0.362) | (0.257) | (0.067) | (0.054) | (0.145) |
| 5-9 Prior Arrests | 4.079 | 2.563 | 0.768 | 0.609 | 0.138 |
| | (2.478) | (1.859) | (0.437) | (0.321) | (0.805) |
| 10+ Prior Arrests | 3.475 | 2.697 | 0.760 | 0.995** | -0.977 |
| | (2.753) | (2.101) | (0.473) | (0.333) | (0.839) |
| Ever Had Violent In-Prison Misconduct | 32.020*** | 21.437*** | 4.909*** | 3.631*** | 2.043 |
| | (3.476) | (2.617) | (0.635) | (0.408) | (1.178) |
| Ever Had Drug In-Prison Misconduct | -13.001*** | -11.402*** | -1.396* | -0.559 | 0.357 |
| | (3.390) | (2.662) | (0.589) | (0.408) | (1.103) |
| Ever Had Contraband In-Prison Misconduct | 25.347*** | 17.226*** | 3.210*** | 2.057*** | 2.853* |
| | (3.624) | (2.743) | (0.672) | (0.444) | (1.269) |
| Ever Had Disobedience In-Prison Misconduct | 16.285*** | 11.603*** | 2.350*** | 1.591*** | 0.740 |
| | (3.104) | (2.235) | (0.632) | (0.413) | (1.127) |
| *Risk Scores* | | | | | |
| Middle Assault Risk (ref: Low Risk) | 11.308*** | 7.209*** | 1.064** | 1.142*** | 1.894* |
| | (2.287) | (1.715) | (0.389) | (0.290) | (0.756) |
| High Assault Risk | 63.985*** | 49.087*** | 7.709*** | 5.125*** | 2.063 |
| | (10.447) | (8.621) | (1.830) | (1.140) | (2.792) |
| Middle Property Risk (ref: Low Risk) | 5.271* | 2.799 | 1.257*** | 0.611* | 0.604 |
| | (2.064) | (1.590) | (0.376) | (0.274) | (0.572) |
| High Property Risk | 19.672*** | 10.927*** | 2.782*** | 2.872*** | 3.090* |
| | (3.886) | (2.974) | (0.657) | (0.460) | (1.236) |
| *Prison Length* | | | | | |
| Logged Time in Prison (Months) | 24.173*** | 12.871*** | 3.282*** | 3.282*** | 4.738*** |
| | (2.198) | (1.659) | (0.360) | (0.316) | (0.790) |
| Constant | -6.546 | -8.440* | -1.124 | -0.956 | 3.974* |
| | (5.474) | (3.987) | (0.944) | (0.796) | (1.994) |
| Observations | 43,083 | 43,083 | 43,083 | 43,083 | 43,083 |

Note: Selected coefficients shown. Models control for all covariates listed in Supplemental Table A-S1 as well as sentencing year and county fixed effects.

*** p<0.001, ** p<0.01, * p<0.05

Table A-4. Frequency of Solitary Confinement Spells, by Type of Confinement

| | Any Solitary Confinement | | Administrative | | Punitive | | Temporary | | Protective | |
|---|---|---|---|---|---|---|---|---|---|---|
| | coef. | IRR | coef. | IRR | coef. | IRR | coef. | IRR | coef. | IRR |
| *Demographic Characteristics* | | | | | | | | | | |
| Non-White | 0.080* | 1.083* | 0.245*** | 1.278*** | 0.016 | 1.016 | -0.035 | 0.966 | -0.326** | 0.722** |
| | (0.034) | (0.037) | (0.047) | (0.060) | (0.043) | (0.043) | (0.032) | (0.031) | (0.109) | (0.079) |
| Female | 0.024 | 1.025 | 0.191* | 1.211* | -4.557*** | 0.010*** | 0.392*** | 1.480*** | -3.823*** | 0.022*** |
| | (0.061) | (0.062) | (0.074) | (0.090) | (0.533) | (0.006) | (0.074) | (0.109) | (1.007) | (0.022) |
| Age at Sentence | | | | | | | | | | |
| 14-20 (ref: 31-35) | 1.071*** | 2.917*** | 1.195*** | 3.303*** | 1.074*** | 2.928*** | 0.914*** | 2.495*** | 1.176*** | 3.240*** |
| | (0.061) | (0.178) | (0.083) | (0.273) | (0.080) | (0.234) | (0.061) | (0.153) | (0.211) | (0.684) |
| 21-25 | 0.671*** | 1.957*** | 0.715*** | 2.044*** | 0.620*** | 1.858*** | 0.631*** | 1.880*** | 0.916*** | 2.499*** |
| | (0.055) | (0.107) | (0.075) | (0.153) | (0.073) | (0.135) | (0.055) | (0.103) | (0.188) | (0.471) |
| 26-30 | 0.294*** | 1.342*** | 0.282*** | 1.325*** | 0.304*** | 1.356*** | 0.278*** | 1.321*** | 0.565** | 1.760** |
| | (0.053) | (0.072) | (0.071) | (0.095) | (0.070) | (0.095) | (0.055) | (0.072) | (0.184) | (0.323) |
| 36-40 | -0.123* | 0.884* | -0.044 | 0.957 | -0.201** | 0.818** | -0.157** | 0.855** | -0.196 | 0.822 |
| | (0.058) | (0.051) | (0.082) | (0.079) | (0.077) | (0.063) | (0.057) | (0.049) | (0.189) | (0.155) |
| 41-45 | -0.256*** | 0.774*** | -0.161 | 0.851 | -0.367*** | 0.693*** | -0.289*** | 0.749*** | -0.329 | 0.719 |
| | (0.066) | (0.051) | (0.093) | (0.079) | (0.088) | (0.061) | (0.067) | (0.050) | (0.214) | (0.154) |
| 46-50 | -0.468*** | 0.626*** | -0.459*** | 0.632*** | -0.430*** | 0.651*** | -0.474*** | 0.623*** | -0.885*** | 0.413*** |
| | (0.075) | (0.047) | (0.106) | (0.067) | (0.105) | (0.068) | (0.081) | (0.050) | (0.259) | (0.107) |
| 51+ | -0.637*** | 0.529*** | -0.487*** | 0.614*** | -0.725*** | 0.484*** | -0.765*** | 0.465*** | -0.604* | 0.546* |
| | (0.104) | (0.055) | (0.141) | (0.087) | (0.148) | (0.072) | (0.102) | (0.047) | (0.302) | (0.165) |
| Known Homosexual | 0.521*** | 1.683*** | 0.433** | 1.543** | 0.600** | 1.823** | 0.522*** | 1.685*** | 0.968* | 2.633* |
| | (0.127) | (0.214) | (0.153) | (0.236) | (0.194) | (0.354) | (0.132) | (0.222) | (0.378) | (0.994) |
| *Human Capital* | | | | | | | | | | |
| Pre-Sentence Employment | -0.013*** | 0.987*** | -0.014*** | 0.986*** | -0.013*** | 0.988*** | -0.011*** | 0.989*** | -0.017*** | 0.984*** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) |
| *Health and Substance Use History* | | | | | | | | | | |
| Mental Illness History | 0.498*** | 1.646*** | 0.568*** | 1.765*** | 0.493*** | 1.637*** | 0.452*** | 1.572*** | 0.192 | 1.211 |
| | (0.034) | (0.055) | (0.046) | (0.081) | (0.044) | (0.072) | (0.032) | (0.050) | (0.110) | (0.134) |
| Any Use of Marijuana | -0.024 | 0.977 | -0.045 | 0.956 | 0.058 | 1.060 | -0.030 | 0.971 | -0.124 | 0.883 |
| | (0.035) | (0.034) | (0.047) | (0.045) | (0.046) | (0.049) | (0.034) | (0.033) | (0.116) | (0.102) |
| Any Use of Stimulants | 0.004 | 1.004 | -0.052 | 0.949 | 0.037 | 1.037 | 0.057 | 1.059 | -0.051 | 0.950 |
| | (0.033) | (0.033) | (0.046) | (0.044) | (0.044) | (0.045) | (0.033) | (0.035) | (0.104) | (0.098) |
| Any Use of Opioids | 0.011 | 1.011 | -0.002 | 0.998 | -0.002 | 0.998 | 0.038 | 1.039 | -0.042 | 0.959 |
| | (0.040) | (0.041) | (0.058) | (0.058) | (0.053) | (0.053) | (0.039) | (0.041) | (0.140) | (0.134) |
| Any Use of Other Drugs | 0.143*** | 1.154*** | 0.137** | 1.146** | 0.176*** | 1.192*** | 0.132*** | 1.141*** | 0.104 | 1.109 |
| | (0.034) | (0.039) | (0.046) | (0.053) | (0.043) | (0.051) | (0.034) | (0.039) | (0.112) | (0.124) |
| Self-Reported Physical Disability | 0.039 | 1.040 | 0.016 | 1.016 | 0.037 | 1.038 | 0.075** | 1.078** | -0.017 | 0.983 |
| | (0.030) | (0.031) | (0.041) | (0.042) | (0.038) | (0.040) | (0.029) | (0.031) | (0.094) | (0.093) |
| *Criminal History* | | | | | | | | | | |
| Prior Felonies | 0.003 | 1.003 | -0.001 | 0.999 | 0.002 | 1.002 | 0.008 | 1.008 | 0.020 | 1.020 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | (0.006) | (0.006) | (0.009) | (0.009) | (0.009) | (0.009) | (0.006) | (0.006) | (0.019) | (0.019) |
| 5-9 Prior Arrests | 0.070* | 1.072* | 0.085 | 1.089 | 0.015 | 1.015 | 0.090* | 1.094* | 0.017 | 1.017 |
| | (0.035) | (0.038) | (0.047) | (0.051) | (0.045) | (0.045) | (0.035) | (0.038) | (0.115) | (0.117) |
| 10+ Prior Arrests | 0.143*** | 1.154*** | 0.164** | 1.179** | 0.113* | 1.119* | 0.156*** | 1.169*** | -0.006 | 0.994 |
| | (0.042) | (0.048) | (0.057) | (0.068) | (0.052) | (0.058) | (0.038) | (0.045) | (0.138) | (0.137) |
| Ever Had Violent In-Prison Misconduct | 0.626*** | 1.870*** | 0.767*** | 2.154*** | 0.592*** | 1.807*** | 0.501*** | 1.650*** | 0.560*** | 1.750*** |
| | (0.049) | (0.091) | (0.070) | (0.150) | (0.063) | (0.115) | (0.048) | (0.079) | (0.148) | (0.259) |
| Ever Had Drug In-Prison Misconduct | -0.022 | 0.978 | -0.116 | 0.890 | 0.062 | 1.064 | 0.028 | 1.029 | 0.093 | 1.098 |
| | (0.047) | (0.046) | (0.065) | (0.058) | (0.059) | (0.062) | (0.049) | (0.051) | (0.144) | (0.158) |
| Ever Had Contraband In-Prison Misconduct | 0.433*** | 1.542*** | 0.542*** | 1.719*** | 0.362*** | 1.436*** | 0.347*** | 1.415*** | 0.480*** | 1.616*** |
| | (0.048) | (0.074) | (0.065) | (0.112) | (0.061) | (0.088) | (0.049) | (0.069) | (0.146) | (0.236) |
| Ever Had Disobedience In-Prison Misconduct | 0.537*** | 1.711*** | 0.672*** | 1.958*** | 0.521*** | 1.684*** | 0.404*** | 1.498*** | 0.438* | 1.550* |
| | (0.074) | (0.127) | (0.104) | (0.204) | (0.102) | (0.171) | (0.064) | (0.095) | (0.202) | (0.314) |
| *Risk Scores* | | | | | | | | | | |
| Middle Assault Risk (ref: Low Risk) | 0.401*** | 1.493*** | 0.410*** | 1.507*** | 0.384*** | 1.467*** | 0.392*** | 1.479*** | 0.511*** | 1.666*** |
| | (0.039) | (0.058) | (0.054) | (0.081) | (0.048) | (0.070) | (0.037) | (0.055) | (0.129) | (0.215) |
| High Assault Risk | 0.516*** | 1.675*** | 0.526*** | 1.691*** | 0.489*** | 1.630*** | 0.533*** | 1.705*** | 0.230 | 1.259 |
| | (0.068) | (0.114) | (0.093) | (0.158) | (0.082) | (0.134) | (0.071) | (0.121) | (0.217) | (0.274) |
| Middle Property Risk (ref: Low Risk) | 0.047 | 1.048 | 0.022 | 1.022 | 0.066 | 1.068 | 0.049 | 1.050 | 0.155 | 1.167 |
| | (0.036) | (0.038) | (0.050) | (0.051) | (0.046) | (0.049) | (0.036) | (0.037) | (0.114) | (0.133) |
| High Property Risk | 0.165*** | 1.180*** | 0.159** | 1.172** | 0.143** | 1.154** | 0.170*** | 1.186*** | 0.233 | 1.262 |
| | (0.041) | (0.049) | (0.056) | (0.066) | (0.052) | (0.060) | (0.040) | (0.048) | (0.135) | (0.170) |
| *Prison Length* | | | | | | | | | | |
| Logged Time in Prison (Months) | 0.349*** | 1.418*** | 0.341*** | 1.406*** | 0.363*** | 1.437*** | 0.329*** | 1.389*** | 0.559*** | 1.748*** |
| | (0.023) | (0.033) | (0.031) | (0.043) | (0.028) | (0.040) | (0.024) | (0.033) | (0.068) | (0.119) |
| Constant | -0.723*** | 0.485*** | -1.792*** | 0.167*** | -2.425*** | 0.088*** | -1.604*** | 0.201*** | -3.547*** | 0.029*** |
| | (0.103) | (0.050) | (0.139) | (0.023) | (0.136) | (0.012) | (0.107) | (0.022) | (0.366) | (0.011) |
| Observations | 43,083 | | 43,083 | | 43,083 | | 43,083 | | 43,083 | |

Note: IRR = incidence rate ratio. Selected coefficients shown. Models control for all covariates listed in Supplemental Table A-S1 as well as sentencing year and county fixed effects.

*** p<0.001, ** p<0.01, * p<0.05

Table A-5. Probability of Solitary Confinement, Race Interactions

| | Any Solitary Confinement | | Administrative | | Punitive | | Temporary | | Protective | |
|---|---|---|---|---|---|---|---|---|---|---|
| | coef. | odds ratio | coef. | odds ratio | coef. | odds ratio | coef. | odds ratio | coef. | odds ratio |
| *A. Race X Mental Illness History* | | | | | | | | | | |
| Non-White X Mental Illness History | 0.245*** | 1.277*** | 0.092 | 1.096 | 0.171* | 1.186* | 0.242*** | 1.274*** | -0.093 | 0.912 |
| | (0.060) | (0.077) | (0.068) | (0.075) | (0.077) | (0.091) | (0.063) | (0.081) | (0.162) | (0.147) |
| *B. Race X Age Interaction* | | | | | | | | | | |
| Non-White X 14-20 (ref: 31-35) | 0.694*** | 2.003*** | 0.650*** | 1.915*** | 0.701*** | 2.016*** | 0.614*** | 1.848*** | 0.186 | 1.204 |
| | (0.081) | (0.161) | (0.096) | (0.184) | (0.111) | (0.223) | (0.087) | (0.161) | (0.235) | (0.283) |
| Non-White X 21-25 | 0.332*** | 1.394*** | 0.326*** | 1.385*** | 0.332** | 1.394** | 0.363*** | 1.437*** | 0.147 | 1.158 |
| | (0.080) | (0.111) | (0.097) | (0.135) | (0.114) | (0.159) | (0.088) | (0.126) | (0.235) | (0.272) |
| Non-White X 26-30 | 0.198* | 1.219* | 0.180 | 1.197 | 0.134 | 1.143 | 0.166 | 1.180 | -0.329 | 0.719 |
| | (0.085) | (0.104) | (0.105) | (0.125) | (0.123) | (0.140) | (0.094) | (0.111) | (0.257) | (0.185) |
| Non-White X 36-40 | 0.091 | 1.095 | 0.015 | 1.015 | 0.273* | 1.315* | 0.116 | 1.123 | -0.273 | 0.761 |
| | (0.091) | (0.100) | (0.113) | (0.115) | (0.135) | (0.178) | (0.102) | (0.115) | (0.281) | (0.214) |
| Non-White X 41-45 | 0.183 | 1.200 | 0.118 | 1.126 | 0.351* | 1.420* | 0.088 | 1.092 | -0.077 | 0.926 |
| | (0.099) | (0.119) | (0.124) | (0.140) | (0.150) | (0.213) | (0.112) | (0.122) | (0.331) | (0.306) |
| Non-White X 46-50 | 0.205 | 1.228 | 0.092 | 1.096 | 0.294 | 1.342 | 0.233 | 1.262 | -0.352 | 0.704 |
| | (0.118) | (0.145) | (0.152) | (0.167) | (0.183) | (0.245) | (0.134) | (0.169) | (0.434) | (0.305) |
| Non-White X 51+ | -0.185 | 0.831 | -0.199 | 0.820 | 0.263 | 1.301 | -0.134 | 0.874 | -0.726 | 0.484 |
| | (0.142) | (0.118) | (0.181) | (0.149) | (0.230) | (0.299) | (0.167) | (0.146) | (0.517) | (0.250) |
| Observations | 43,083 | | 43,083 | | 43,083 | | 43,083 | | 43,083 | |

Note: Each set of interactions (A and B) are estimated from a separate model. Selected coefficients shown. Models control for all covariates listed in Supplemental Table A-S1 as well as sentencing year and county fixed effects.
*** p<0.001, ** p<0.01, * p<0.05

Table A-6. Cumulative Days in Solitary Confinement, Race Interactions

| | Any Solitary Confinement coef. | Administrative coef. | Punitive coef. | Temporary coef. | Protective coef. |
|---|---|---|---|---|---|
| *A. Race X Mental Illness History* | | | | | |
| Non-White X Mental Illness History | 16.419** | 12.156** | 3.321** | 2.001** | -1.058 |
| | (6.081) | (4.660) | (1.288) | (0.756) | (1.248) |
| *B. Race X Age Interaction* | | | | | |
| Non-White X 14-20 (ref: 31-35) | 43.145*** | 38.296*** | 4.865*** | 4.301*** | -4.317* |
| | (7.038) | (5.311) | (1.434) | (0.910) | (1.901) |
| Non-White X 21-25 | 11.901* | 14.053** | 0.852 | 0.399 | -3.402 |
| | (5.791) | (4.373) | (1.188) | (0.792) | (1.796) |
| Non-White X 26-30 | -5.006 | 1.516 | -0.351 | -0.634 | -5.538** |
| | (5.505) | (4.001) | (1.219) | (0.738) | (1.855) |
| Non-White X 36-40 | -3.924 | -0.565 | -1.478 | 0.335 | -2.216 |
| | (5.568) | (4.335) | (1.104) | (0.802) | (1.711) |
| Non-White X 41-45 | -3.148 | 0.708 | -1.583 | -1.128 | -1.145 |
| | (5.435) | (4.133) | (1.065) | (0.829) | (1.641) |
| Non-White X 46-50 | -10.607* | -6.328 | -1.784 | -0.446 | -2.050 |
| | (5.195) | (3.620) | (1.258) | (0.767) | (1.798) |
| Non-White X 51+ | -2.606 | 1.297 | -1.276 | -1.438 | -1.188 |
| | (6.935) | (5.249) | (1.257) | (1.154) | (1.777) |
| Observations | 43,083 | 43,083 | 43,083 | 43,083 | 43,083 |

Note: Each set of interactions (A and B) are estimated from a separate model. Selected coefficients shown. Models control for all covariates listed in Supplemental Table A-S1 as well as sentencing year and county fixed effects.
*** p<0.001, ** p<0.01, * p<0.05

Table A-7. Frequency of Spells, Race Interaction

| | Any Solitary Confinement | | Administrative | | Punitive | | Temporary | | Protective | |
|---|---|---|---|---|---|---|---|---|---|---|
| | coef. | IRR | coef. | IRR | coef. | IRR | coef. | IRR | coef. | IRR |
| *Race X Mental Illness History* | | | | | | | | | | |
| Non-White X Mental Illness History | 0.126 | 1.135 | 0.071 | 1.074 | 0.178* | 1.195* | 0.129* | 1.138* | 0.213 | 1.238 |
| | (0.064) | (0.073) | (0.088) | (0.094) | (0.084) | (0.101) | (0.060) | (0.069) | (0.211) | (0.261) |
| *Race X Age Interaction* | | | | | | | | | | |
| Non-White X 14-20 (ref: 31-35) | 0.522*** | 1.686*** | 0.484*** | 1.622*** | 0.568*** | 1.766*** | 0.531*** | 1.701*** | 0.103 | 1.108 |
| | (0.095) | (0.160) | (0.127) | (0.207) | (0.129) | (0.228) | (0.096) | (0.163) | (0.321) | (0.355) |
| Non-White X 21-25 | 0.209* | 1.232* | 0.196 | 1.216 | 0.211 | 1.235 | 0.208* | 1.232* | 0.007 | 1.008 |
| | (0.098) | (0.121) | (0.134) | (0.163) | (0.133) | (0.165) | (0.099) | (0.122) | (0.310) | (0.313) |
| Non-White X 26-30 | -0.058 | 0.944 | -0.103 | 0.902 | 0.032 | 1.033 | -0.007 | 0.993 | -0.660 | 0.517 |
| | (0.103) | (0.097) | (0.137) | (0.124) | (0.138) | (0.142) | (0.106) | (0.105) | (0.341) | (0.176) |
| Non-White X 36-40 | 0.081 | 1.084 | 0.000 | 1.000 | 0.091 | 1.095 | 0.174 | 1.190 | -0.188 | 0.829 |
| | (0.114) | (0.123) | (0.162) | (0.162) | (0.151) | (0.165) | (0.113) | (0.135) | (0.365) | (0.302) |
| Non-White X 41-45 | 0.029 | 1.029 | 0.121 | 1.129 | 0.117 | 1.124 | -0.100 | 0.905 | -0.226 | 0.797 |
| | (0.130) | (0.134) | (0.178) | (0.201) | (0.171) | (0.192) | (0.128) | (0.116) | (0.414) | (0.330) |
| Non-White X 46-50 | 0.053 | 1.055 | -0.012 | 0.988 | 0.101 | 1.107 | 0.110 | 1.116 | -0.193 | 0.825 |
| | (0.145) | (0.153) | (0.203) | (0.200) | (0.204) | (0.226) | (0.156) | (0.174) | (0.508) | (0.419) |
| Non-White X 51+ | -0.116 | 0.890 | -0.302 | 0.739 | 0.027 | 1.028 | -0.012 | 0.988 | -0.144 | 0.865 |
| | (0.202) | (0.180) | (0.274) | (0.203) | (0.284) | (0.292) | (0.197) | (0.195) | (0.616) | (0.533) |
| Observations | 43,083 | | 43,083 | | 43,083 | | 43,083 | | 43,083 | |

Note: IRR = incidence rate ratio. Each set of interactions (A and B) are estimated from a separate model. Selected coefficients shown. Models control for all covariates listed in Supplemental Table A-S1 as well as sentencing year and county fixed effects.

*** p<0.001, ** p<0.01, * p<0.05

Table A-S1. Summary Statistics of Covariates

| | Full Sample | | Ever in Solitary Confinement | | Never in Solitary Confinement | |
|---|---|---|---|---|---|---|
| | Mean / % | SD | Mean / % | SD | Mean / % | SD |
| *Demographic Characteristics* | | | | | | |
| Non-White | 0.47 | 0.50 | 0.50 | 0.50 | 0.45 | 0.50 |
| Female | 0.07 | 0.26 | 0.08 | 0.27 | 0.07 | 0.26 |
| Age at Sentence | 31.33 | 10.50 | 28.79 | 9.91 | 32.66 | 10.56 |
| Single | 0.70 | 0.46 | 0.77 | 0.42 | 0.66 | 0.47 |
| Known Homosexual | 0.01 | 0.08 | 0.01 | 0.09 | 0.01 | 0.07 |
| *Human Capital* | | | | | | |
| Less than HS | 0.45 | 0.50 | 0.50 | 0.50 | 0.43 | 0.49 |
| GED | 0.20 | 0.40 | 0.20 | 0.40 | 0.19 | 0.39 |
| HS | 0.28 | 0.45 | 0.24 | 0.43 | 0.30 | 0.46 |
| More than HS | 0.07 | 0.25 | 0.05 | 0.23 | 0.07 | 0.26 |
| Pre-Sentence Employment | 0.29 | 0.28 | 0.22 | 0.25 | 0.32 | 0.29 |
| *Health and Substance Abuse* | | | | | | |
| History of Mental Illness | 0.19 | 0.39 | 0.23 | 0.42 | 0.17 | 0.37 |
| Underweight | 0.01 | 0.11 | 0.01 | 0.11 | 0.01 | 0.10 |
| Normal Weight | 0.46 | 0.50 | 0.47 | 0.50 | 0.45 | 0.50 |
| Overweight | 0.37 | 0.48 | 0.36 | 0.48 | 0.37 | 0.48 |
| Obese | 0.17 | 0.37 | 0.16 | 0.37 | 0.17 | 0.38 |
| History of Alcohol use | 0.69 | 0.46 | 0.66 | 0.47 | 0.71 | 0.46 |
| History of Marijuana Use | 0.68 | 0.47 | 0.69 | 0.46 | 0.67 | 0.47 |
| History of Stimulants Use | 0.42 | 0.49 | 0.39 | 0.49 | 0.43 | 0.49 |
| History of Opioids Use | 0.15 | 0.35 | 0.15 | 0.35 | 0.15 | 0.36 |
| History of Other Drug Use | 0.24 | 0.43 | 0.26 | 0.44 | 0.23 | 0.42 |
| Health Insurance at Sentencing | 0.24 | 0.42 | 0.24 | 0.43 | 0.24 | 0.42 |
| Physical Disability | 0.36 | 0.48 | 0.35 | 0.48 | 0.36 | 0.48 |
| *Criminal History* | | | | | | |
| 0-4 Prior Arrests | 0.28 | 0.45 | 0.30 | 0.46 | 0.28 | 0.45 |
| 5-9 Prior Arrests | 0.31 | 0.46 | 0.31 | 0.46 | 0.31 | 0.46 |
| 10+ Prior Arrests | 0.40 | 0.49 | 0.40 | 0.49 | 0.41 | 0.49 |
| Prior Felony Convictions | 2.10 | 2.97 | 2.02 | 3.08 | 2.14 | 2.90 |
| Prior Adult Jail Commitments | 2.78 | 3.84 | 2.61 | 3.83 | 2.86 | 3.85 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Prior Adult Prison Commitments | 0.97 | 1.67 | 0.99 | 1.78 | 0.96 | 1.61 |
| Prior Adult Probation Commitments | 1.76 | 1.97 | 1.57 | 1.87 | 1.85 | 2.01 |
| Prior Months in Prison | 22.66 | 43.60 | 25.33 | 47.21 | 21.27 | 41.53 |
| Prior In-Prison Violent Misconduct | 0.13 | 0.34 | 0.18 | 0.39 | 0.10 | 0.30 |
| Prior In-Prison Drug Misconduct | 0.13 | 0.33 | 0.14 | 0.34 | 0.12 | 0.32 |
| Prior In-Prison Contraband Misconduct | 0.12 | 0.32 | 0.16 | 0.36 | 0.10 | 0.29 |
| Prior In-Prison Disobeying Misconduct | 0.25 | 0.43 | 0.30 | 0.46 | 0.23 | 0.42 |
| *Statistical Risk Assessments* | | | | | | |
| Low Assault Risk | 0.51 | 0.50 | 0.37 | 0.48 | 0.58 | 0.49 |
| Middle Assault Risk | 0.47 | 0.50 | 0.58 | 0.49 | 0.40 | 0.49 |
| High Assault Risk | 0.02 | 0.15 | 0.05 | 0.21 | 0.01 | 0.11 |
| Low Property Risk | 0.39 | 0.49 | 0.33 | 0.47 | 0.43 | 0.49 |
| Middle Property Risk | 0.41 | 0.49 | 0.39 | 0.49 | 0.42 | 0.49 |
| High Property Risk | 0.20 | 0.40 | 0.28 | 0.45 | 0.15 | 0.36 |
| *Sentencing Factors* | | | | | | |
| Sentenced to Jail at Baseline | 0.07 | 0.25 | 0.07 | 0.25 | 0.07 | 0.25 |
| Sentenced to Jail and Probation at Baseline | 0.26 | 0.44 | 0.24 | 0.43 | 0.27 | 0.44 |
| Sentenced to Prison at Baseline | 0.53 | 0.50 | 0.55 | 0.50 | 0.52 | 0.50 |
| Sentenced to Probation at Baseline | 0.15 | 0.35 | 0.15 | 0.35 | 0.15 | 0.36 |
| Controlled Substance Crime | 0.20 | 0.40 | 0.15 | 0.36 | 0.23 | 0.42 |
| Violent Crime | 0.38 | 0.49 | 0.46 | 0.50 | 0.34 | 0.47 |
| Property Crime | 0.25 | 0.43 | 0.25 | 0.43 | 0.24 | 0.43 |
| Public Order Crime | 0.03 | 0.18 | 0.02 | 0.15 | 0.04 | 0.19 |
| Public Safety Crime | 0.14 | 0.35 | 0.12 | 0.33 | 0.15 | 0.36 |
| Total Offense Severity Score | 22.98 | 28.37 | 27.56 | 33.16 | 20.59 | 25.19 |
| Violent Offense in Sentence Cluster | 0.42 | 0.49 | 0.50 | 0.50 | 0.38 | 0.48 |
| Length of Prison Sentence | 24.83 | 53.18 | 37.41 | 74.51 | 18.26 | 35.75 |
| Observations | 46,513 | | 15,965 (34.3%) | | 30,548 (65.7%) | |

Table A-S2. Summary Statistics of Covariates, by Type of Isolation

| | Any Administrative Segregation | | Any Punitive | | Any Temporary | | Any Protective | |
|---|---|---|---|---|---|---|---|---|
| | Mean / % | SD | Mean / % | SD | Mean / % | SD | Mean / % | SD |
| *Demographic Characteristics* | | | | | | | | |
| Non-White | 0.51 | 0.50 | 0.54 | 0.50 | 0.52 | 0.50 | 0.58 | 0.49 |
| Female | 0.10 | 0.29 | 0.00 | 0.03 | 0.05 | 0.22 | 0.00 | 0.03 |
| Age at Sentence | 28.07 | 9.76 | 26.97 | 9.31 | 28.22 | 9.67 | 26.79 | 8.97 |
| Single | 0.79 | 0.41 | 0.83 | 0.38 | 0.79 | 0.40 | 0.83 | 0.37 |
| Known Homosexual | 0.01 | 0.10 | 0.01 | 0.10 | 0.01 | 0.10 | 0.01 | 0.10 |
| *Human Capital* | | | | | | | | |
| Less than HS | 0.51 | 0.50 | 0.54 | 0.50 | 0.52 | 0.50 | 0.51 | 0.50 |
| GED | 0.20 | 0.40 | 0.20 | 0.40 | 0.20 | 0.40 | 0.19 | 0.39 |
| HS | 0.24 | 0.42 | 0.22 | 0.41 | 0.23 | 0.42 | 0.25 | 0.44 |
| More than HS | 0.05 | 0.23 | 0.04 | 0.20 | 0.05 | 0.22 | 0.04 | 0.20 |
| Pre-Sentence Employment | 0.21 | 0.24 | 0.19 | 0.23 | 0.21 | 0.24 | 0.17 | 0.21 |
| *Health and Substance Abuse* | | | | | | | | |
| History of Mental Illness | 0.24 | 0.43 | 0.23 | 0.42 | 0.23 | 0.42 | 0.20 | 0.40 |
| Underweight | 0.01 | 0.11 | 0.01 | 0.12 | 0.01 | 0.12 | 0.01 | 0.12 |
| Normal Weight | 0.48 | 0.50 | 0.47 | 0.50 | 0.47 | 0.50 | 0.45 | 0.50 |
| Overweight | 0.35 | 0.48 | 0.36 | 0.48 | 0.35 | 0.48 | 0.37 | 0.48 |
| Obese | 0.16 | 0.37 | 0.15 | 0.36 | 0.16 | 0.36 | 0.17 | 0.37 |
| History of Alcohol use | 0.64 | 0.48 | 0.62 | 0.48 | 0.66 | 0.48 | 0.56 | 0.50 |
| History of Marijuana Use | 0.68 | 0.47 | 0.70 | 0.46 | 0.70 | 0.46 | 0.64 | 0.48 |
| History of Stimulants Use | 0.37 | 0.48 | 0.35 | 0.48 | 0.38 | 0.49 | 0.29 | 0.46 |
| History of Opioids Use | 0.14 | 0.35 | 0.13 | 0.33 | 0.14 | 0.35 | 0.10 | 0.30 |
| History of Other Drug Use | 0.28 | 0.45 | 0.29 | 0.45 | 0.26 | 0.44 | 0.31 | 0.46 |
| Health Insurance at Sentencing | 0.24 | 0.43 | 0.24 | 0.42 | 0.24 | 0.43 | 0.21 | 0.41 |
| Physical Disability | 0.35 | 0.48 | 0.33 | 0.47 | 0.34 | 0.47 | 0.30 | 0.46 |
| *Criminal History* | | | | | | | | |
| 0-4 Prior Arrests | 0.30 | 0.46 | 0.32 | 0.47 | 0.30 | 0.46 | 0.31 | 0.46 |
| 5-9 Prior Arrests | 0.31 | 0.46 | 0.31 | 0.46 | 0.31 | 0.46 | 0.33 | 0.47 |
| 10+ Prior Arrests | 0.38 | 0.49 | 0.38 | 0.48 | 0.39 | 0.49 | 0.36 | 0.48 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Prior Felony Convictions | 1.90 | 2.98 | 1.85 | 3.00 | 1.99 | 3.08 | 1.85 | 2.62 |
| Prior Adult Jail Commitments | 2.58 | 3.88 | 2.25 | 3.39 | 2.55 | 3.79 | 2.09 | 3.10 |
| Prior Adult Prison Commitments | 0.94 | 1.70 | 0.97 | 1.66 | 0.98 | 1.73 | 1.02 | 1.65 |
| Prior Adult Probation Commitments | 1.53 | 1.86 | 1.35 | 1.72 | 1.51 | 1.80 | 1.28 | 1.59 |
| Prior Months in Prison | 24.77 | 47.11 | 26.91 | 49.40 | 25.74 | 47.89 | 29.14 | 51.51 |
| Prior In-Prison Violent Misconduct | 0.19 | 0.40 | 0.21 | 0.41 | 0.19 | 0.39 | 0.24 | 0.43 |
| Prior In-Prison Drug Misconduct | 0.13 | 0.34 | 0.14 | 0.35 | 0.14 | 0.35 | 0.16 | 0.36 |
| Prior In-Prison Contraband Misconduct | 0.17 | 0.37 | 0.18 | 0.38 | 0.16 | 0.37 | 0.21 | 0.41 |
| Prior In-Prison Disobeying Misconduct | 0.29 | 0.46 | 0.31 | 0.46 | 0.30 | 0.46 | 0.35 | 0.48 |
| *Statistical Risk Assessments* | | | | | | | | |
| Low Assault Risk | 0.35 | 0.48 | 0.26 | 0.44 | 0.34 | 0.47 | 0.73 | 0.45 |
| Middle Assault Risk | 0.60 | 0.49 | 0.67 | 0.47 | 0.61 | 0.49 | 0.07 | 0.25 |
| High Assault Risk | 0.05 | 0.22 | 0.06 | 0.24 | 0.05 | 0.22 | 0.30 | 0.46 |
| Low Property Risk | 0.32 | 0.47 | 0.31 | 0.46 | 0.32 | 0.47 | 0.33 | 0.47 |
| Middle Property Risk | 0.38 | 0.49 | 0.34 | 0.48 | 0.38 | 0.48 | 0.36 | 0.48 |
| High Property Risk | 0.30 | 0.46 | 0.34 | 0.47 | 0.31 | 0.46 | 0.06 | 0.24 |
| *Sentencing Factors* | | | | | | | | |
| Sentenced to Jail at Baseline | 0.06 | 0.25 | 0.06 | 0.23 | 0.07 | 0.25 | 0.19 | 0.39 |
| Sentenced to Jail and Probation at Baseline | 0.24 | 0.42 | 0.22 | 0.42 | 0.24 | 0.43 | 0.64 | 0.48 |
| Sentenced to Prison at Baseline | 0.56 | 0.50 | 0.57 | 0.49 | 0.55 | 0.50 | 0.11 | 0.32 |
| Sentenced to Probation at Baseline | 0.14 | 0.35 | 0.15 | 0.35 | 0.15 | 0.35 | 0.12 | 0.32 |
| Controlled Substance Crime | 0.14 | 0.34 | 0.12 | 0.32 | 0.14 | 0.35 | 0.53 | 0.50 |
| Violent Crime | 0.47 | 0.50 | 0.50 | 0.50 | 0.47 | 0.50 | 0.21 | 0.41 |
| Property Crime | 0.24 | 0.43 | 0.23 | 0.42 | 0.24 | 0.43 | 0.01 | 0.11 |
| Public Order Crime | 0.02 | 0.15 | 0.02 | 0.14 | 0.02 | 0.15 | 0.13 | 0.34 |
| Public Safety Crime | 0.13 | 0.34 | 0.13 | 0.34 | 0.12 | 0.32 | 35.15 | 38.06 |
| Total Offense Severity Score | 28.68 | 34.04 | 30.56 | 35.88 | 28.38 | 33.77 | 0.59 | 0.49 |
| Violent Offense in Sentence Cluster | 0.51 | 0.50 | 0.54 | 0.50 | 0.52 | 0.50 | 60.64 | 99.55 |
| Length of Prison Sentence | 40.30 | 77.94 | 46.66 | 87.96 | 39.06 | 77.43 | 0.21 | 0.40 |
| Observations | 8,978 | | 6,756 | | 11,383 | | 1,331 | |
| Proportion of Overall Sample | 19.3% | | 14.5% | | 24.5% | | 2.9% | |

Table A-S3. Statistical Assessment of Assault Risk

| | Low vs. Middle Assault | | Low vs. High Assault | |
|---|---|---|---|---|
| | coef. | coef. | exp. | exp. |
| *Demographic Characteristics* | | | | |
| Non-White | 0.099*** | 0.329*** | 1.104*** | 1.389*** |
| | (0.026) | (0.083) | (0.029) | (0.116) |
| Female | -3.342*** | -16.434*** | 0.035*** | 0.000*** |
| | (0.105) | (0.122) | (0.004) | (0.000) |
| 14-20 (ref: 31-35) | 1.568*** | 2.145*** | 4.796*** | 8.545*** |
| | (0.050) | (0.265) | (0.242) | (2.262) |
| 21-25 | 1.073*** | 1.641*** | 2.924*** | 5.159*** |
| | (0.043) | (0.145) | (0.127) | (0.750) |
| 26-30 | 0.619*** | 0.952*** | 1.857*** | 2.591*** |
| | (0.043) | (0.119) | (0.080) | (0.307) |
| 36-40 | -0.294*** | -0.293* | 0.745*** | 0.746* |
| | (0.045) | (0.120) | (0.034) | (0.089) |
| 41-45 | -0.534*** | -0.528*** | 0.586*** | 0.590*** |
| | (0.049) | (0.136) | (0.029) | (0.080) |
| 46-50 | -0.672*** | -0.845*** | 0.510*** | 0.430*** |
| | (0.058) | (0.171) | (0.030) | (0.074) |
| 51+ | -0.408*** | -0.890*** | 0.665*** | 0.411*** |
| | (0.062) | (0.213) | (0.041) | (0.087) |
| Known Homosexual | 0.257 | 0.124 | 1.293 | 1.132 |
| | (0.142) | (0.321) | (0.183) | (0.363) |
| Single | -0.088** | -0.083 | 0.916** | 0.920 |
| | (0.030) | (0.089) | (0.028) | (0.082) |
| *Human Capital* | | | | |
| GED (ref: Less Than High School) | 0.173*** | 0.223** | 1.189*** | 1.250** |
| | (0.033) | (0.085) | (0.039) | (0.107) |
| High School | -0.236*** | -0.148 | 0.790*** | 0.862 |
| | (0.028) | (0.100) | (0.022) | (0.086) |
| More Than High School | -0.138** | 0.023 | 0.871** | 1.023 |
| | (0.048) | (0.165) | (0.042) | (0.169) |
| Pre-Sentence Employment | -0.001* | -0.020*** | 0.999* | 0.980*** |
| | (0.000) | (0.002) | (0.000) | (0.002) |
| *Health and Substance Use History* | | | | |
| Mental Illness History | 0.123*** | 0.108 | 1.131*** | 1.115 |
| | (0.031) | (0.102) | (0.035) | (0.114) |
| Underweight (ref: Normal) | 0.092 | -0.527 | 1.096 | 0.590 |

| | | | | |
|---|---|---|---|---|
| | (0.122) | (0.652) | (0.134) | (0.385) |
| Overweight | 0.031 | 0.115 | 1.032 | 1.122 |
| | (0.026) | (0.080) | (0.027) | (0.090) |
| Obese | 0.077* | 0.062 | 1.080* | 1.064 |
| | (0.034) | (0.106) | (0.036) | (0.113) |
| Any Use of Alcohol | -0.020 | -0.229** | 0.981 | 0.795** |
| | (0.029) | (0.085) | (0.028) | (0.067) |
| Any Use of Marijuana | 0.171*** | -0.109 | 1.187*** | 0.897 |
| | (0.029) | (0.090) | (0.034) | (0.081) |
| Any Use of Stimulants | -0.071** | 0.092 | 0.931** | 1.097 |
| | (0.027) | (0.083) | (0.025) | (0.091) |
| Any Use of Opioids | -0.003 | 0.084 | 0.997 | 1.087 |
| | (0.035) | (0.108) | (0.035) | (0.118) |
| Any Use of Other Drugs | 0.092** | 0.054 | 1.097** | 1.055 |
| | (0.030) | (0.095) | (0.033) | (0.100) |
| Health Insurance at Pre-Sentencing | -0.038 | -0.328** | 0.963 | 0.720** |
| | (0.028) | (0.108) | (0.027) | (0.078) |
| Self-Reported Physical Disability | 0.028 | -0.075 | 1.029 | 0.928 |
| | (0.025) | (0.081) | (0.026) | (0.075) |
| *Criminal History* | | | | |
| Prior Felonies | -0.008 | -0.037* | 0.992 | 0.963* |
| | (0.006) | (0.015) | (0.006) | (0.014) |
| 5-9 Prior Arrests | 0.087** | -0.046 | 1.091** | 0.955 |
| | (0.030) | (0.124) | (0.033) | (0.119) |
| 10+ Prior Arrests | 0.041 | -0.234 | 1.042 | 0.791 |
| | (0.034) | (0.131) | (0.036) | (0.104) |
| Prior Adult Jail Commitments | -0.000 | -0.083*** | 1.000 | 0.920*** |
| | (0.004) | (0.015) | (0.004) | (0.014) |
| Prior Adult Prison Commitments | -0.016 | 0.012 | 0.984 | 1.012 |
| | (0.011) | (0.023) | (0.010) | (0.024) |
| Prior Adult Probation Commitments | -0.082*** | -0.056 | 0.921*** | 0.945 |
| | (0.009) | (0.044) | (0.008) | (0.042) |
| Logged Time in Prison Prior to Sentencing | 0.102*** | 0.799*** | 1.107*** | 2.223*** |
| | (0.014) | (0.058) | (0.015) | (0.130) |
| Ever Had Violent In-Prison Misconduct | 0.166*** | 0.906*** | 1.181*** | 2.474*** |
| | (0.047) | (0.100) | (0.056) | (0.248) |
| Ever Had Drug In-Prison Misconduct | -0.036 | 0.012 | 0.965 | 1.012 |
| | (0.045) | (0.085) | (0.044) | (0.086) |
| Ever Had Contraband In-Prison Misconduct | 0.365*** | 0.652*** | 1.440*** | 1.920*** |
| | (0.048) | (0.093) | (0.069) | (0.178) |

| | | | | |
|---|---|---|---|---|
| Ever Had Disobedience In-Prison Misconduct | 0.218*** | 0.390* | 1.243*** | 1.476* |
| | (0.050) | (0.160) | (0.062) | (0.236) |
| Original Sentence, Jail Only (ref: Probation) | 0.249*** | 0.690* | 1.283*** | 1.993* |
| | (0.055) | (0.281) | (0.071) | (0.560) |
| Original Sentence, Jail with Probation | -0.056 | -0.093 | 0.946 | 0.911 |
| | (0.037) | (0.274) | (0.035) | (0.250) |
| Original Sentence, Prison | -1.311*** | -0.044 | 0.269*** | 0.957 |
| | (0.085) | (0.294) | (0.023) | (0.281) |
| Original Sentence, Sentence, Other | 0.769* | 1.889 | 2.157* | 6.614 |
| | (0.311) | (1.044) | (0.672) | (6.903) |
| Sentenced to Person Crime (ref: Controlled Substance) | 0.928*** | 1.322*** | 2.529*** | 3.753*** |
| | (0.036) | (0.123) | (0.092) | (0.461) |
| Sentenced to Property Crime | 0.235*** | 0.412** | 1.265*** | 1.510** |
| | (0.035) | (0.136) | (0.044) | (0.205) |
| Sentenced to Public Order Crime | 0.374*** | 0.212 | 1.454*** | 1.236 |
| | (0.067) | (0.317) | (0.097) | (0.392) |
| Sentenced to Public Safety Crime | 0.010 | 0.517*** | 1.010 | 1.677*** |
| | (0.040) | (0.136) | (0.040) | (0.228) |
| SGL Total Offense Severity Score | 0.008*** | 0.011*** | 1.008*** | 1.011*** |
| | (0.001) | (0.003) | (0.001) | (0.003) |
| SGL Total Offense Severity Score^2 | -0.000 | -0.000 | 1.000 | 1.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| *Prison Length* | | | | |
| Logged Prison Sentence (Months) | 0.556*** | 0.561*** | 1.744*** | 1.752*** |
| | (0.024) | (0.058) | (0.043) | (0.102) |
| Sentenced in 2004 (ref: 2003) | 0.082** | 0.156 | 1.086** | 1.169 |
| | (0.030) | (0.101) | (0.033) | (0.118) |
| Sentenced in 2005 | -0.002 | 0.124 | 0.998 | 1.132 |
| | (0.032) | (0.102) | (0.032) | (0.115) |
| Sentenced in 2006 | -0.052 | -0.088 | 0.949 | 0.916 |
| | (0.033) | (0.105) | (0.031) | (0.096) |
| Constant | -1.453*** | -7.710*** | 0.234*** | 0.000*** |
| | (0.074) | (0.363) | (0.017) | (0.000) |
| Observations | 43,101 | 43,101 | 43,101 | 43,101 |

*** p<0.001, ** p<0.01, * p<0.05

# CHAPTER 2

## THE EFFECT OF SOLITARY CONFINEMENT ON FUTURE CRIMINAL JUSTICE INVOVLEMENT

### Introduction

There has been extraordinary growth in incarceration over the last four decades in the United States. In 1972, the incarceration rate (the number of individuals in prisons and jails per 100,000) was 161 but dramatically rose to 707 per 100,000 in 2012. In total, more than 2.2 million people were in custody in 2012 (Glaze and Herberman 2013). The incarceration rate in the U.S. is among the highest in the world, and its prison population accounts for over 20 percent of the global prison population (Walmsley 2013). One central concern among policy makers and scholars is the impact of imprisonment on public safety, namely reoffending after release (Nagin, Cullen, and Jonson 2009). Research on such effects demonstrates that overall imprisonment has little or no effect on crime prevention, apart from the modest contemporaneous incapacitation effect while individuals are in custody (Harding et al. 2017; National Research Council 2014). This overall effect, however, may mask important heterogeneity that stems from exposure to different confinement conditions, which could influence the relationship between imprisonment and reoffending. This topic has not received adequate attention in research.

Solitary confinement represents one of the most consequential experiences of imprisonment because conditions of confinement are extraordinarily harsh. Individuals are held in small single cells for 22-24 hours a day with little or no opportunity for meaning social contact

and engagement, including access to work, educational, and therapeutic programming. Visitation from relatives and friends on the outside are severely restricted. Privileges such as access to reading, radio, and television and exercise are also highly restricted, if not denied altogether (Frost and Monteiro 2016; Reiter 2017; Smith 2006). Often, environments in these units are marked by hostility and violence, where individuals are subjected to lethal force and even abusive treatment (Arrigo and Bullock 2007; Irwin 2005; Shaylor 1998). Given that the specific deterrence effect of imprisonment is questionable (National Research Council 2014:156) and that experiences in solitary confinement has been associated with increased aggression and violence (Arrigo and Bullock 2007; Haney 2003b; Toch and Adams 2002), individuals exposed to such confinement conditions may be at greater risk for future reoffending and imprisonment.

Despite the widespread use of solitary confinement in U.S. correctional systems (Reiter 2017), there have been few empirical examinations of its long-term effects on reoffending and imprisonment after release from prison (see Lovell et al. 2007; Mears and Bales 2009). This is troubling because research suggests that experiences in solitary confinement produce lasting psychological and social impairment that are detrimental to individuals' ability to successfully transition back into society – and may even increase violent behavior (Arrigo and Bullock 2007; Haney 2003b, 2003a; Rhodes 2004; Toch and Adams 2002). The fact is that the majority of prisoners are eventually released back into society, including many of those who are placed in solitary confinement (Travis 2005). Ultimately, this raises serious concerns about the long-term impacts of solitary confinement on public safety.

This study seeks to address these challenges by leveraging more robust methods and drawing on rich administrative records on individuals sentenced to prison and followed over time after release. It specifically employs inverse probability of treatment weighting regression

(IPTW) to investigate the long-term impacts of solitary confinement on the likelihood of being convicted of new felony (including those for violent crimes) and being re-admitted to prison after release from prison. The study also conducts a number of supplemental analyses to assess the sensitivity of estimates. In addition, this study also assesses multiple expectations regarding the potential positive and negative impacts of solitary.

Investigating the nature and consequences of prison life in general, and solitary confinement in particular, has important implications for understanding punishment and inequality. Imprisonment is a heterogeneous experience, in which individuals are subjected to different confinement conditions, policies, and practices. Examining such variations contributes to a multidimensional perspective of imprisonment, and in turn, helps explain differences in individual outcomes, such as recidivism and mortality after release. This approach is timely because not only has the criminal justice system widened in scope, it has also become more punishing. In particular, penal practices have grown increasingly punitive, yet their short- and long-term consequences are not well known. Solitary confinement deserves particular attention because it represents one of the most intense levels of correctional control and social deprivation. Focusing on this extreme practice provides an opportunity to investigate how the nature of imprisonment shapes behavior and impacts reentry.

## Theoretical Framework

A central concern among policymakers and correctional administrators is whether or not prisoners will engage in future criminal behavior after release. For this reason, much attention has been devoted to understanding the impact of imprisonment on recidivism (National Research Council 2007, 2014). This literature suggests both potential negative and positive (criminogenic)

effects. Below, I draw on research on imprisonment's effect on crime and criminal behavior and theorize about the potential impacts of solitary confinement.

More than mere facilities where offenders serve their time, prisons are powerful social environments that exact significant physical, psychological, and social tolls on individuals who cycle through them, both in the short- and long-term after they are released (National Research Council 2014). Research on the processes through which imprisonment transforms individuals offers insights into its criminogenic effects (or increases in future criminal justice involvement) and the role of confinement conditions, such as solitary confinement, in exacerbating such effects. This line of work identifies at least three potential mechanisms that shed light on how the contexts of prisons, and life in solitary confinement specifically, shape prisoners' behaviors, attitudes, and identities: prisonization, legal cynicism, and stigmatization (Haney 2017).

*Prisonization*

First, prisons are social institutions, defined by formal rules and informal norms that govern interactions among inmates and between inmates and staff (Irwin 2005; Lerman 2013). Socialization into prison life, a process known as "prisonization", requires not only learning rules of the institution (Clemmer 1958) but also developing strategies necessary and appropriate to the particular conditions of prisons. Strategies and adaptations to cope with prison life, while as a matter of survival in the short-term, may disrupt and complicate adjustment to wider society after release from prison, including desistance. Perhaps one of the most corrosive features of prison life is the threat of violence. One strategy to avoid victimization is to be cautious of all encounters and remain inconspicuous by withdrawing from and avoiding social interactions altogether (Haney 2003b). This strategy also entails developing a "prison mask" that conceals emotions while projecting toughness, hypervigilance, and impulsiveness and aggression (Irwin

2005; National Research Council 2014). Some may also engage in violence proactively to deter victimization or respond to conflict (Irwin 2005). In the long run, suspicion of others impedes the ability to sustain social interactions and healthy relationships, and a tendency to resort to aggression and violence intensifies interpersonal conflicts.

The harsh realities of life in solitary confinement likely intensifies the process of prisonization, leading to the development of coping strategies that are even more detrimental to one's ability to avoid crime and ultimately integrate into society upon release. First, solitary confinement severely reduces and erodes meaningful social contact with relatives on the outside. These contacts serve as important buffers to the stresses of life in prison; pro-social influence from family visitation in particular has been associated with reduced reoffending during the transition to society (Bales and Mears 2008; Lerman 2013). Second, complete isolation produces lasting psychological damages – including anxiety, hypersensitivity to stimuli, and paranoia – that increase social withdrawal as well as discomfort, suspicion, and even fear of social interactions (Arrigo and Bullock 2007; Frost and Monteiro 2016; Grassian 2006; Haney 2003a, 2012; Haney and Lynch 1997). Such responses to isolation and attendant consequences exacerbate the challenges of adjusting to life on the outside, which increases strain and risk of reoffending (Haney 2003b). Third, the intense stresses of life in isolation induce maladaptive coping strategies that encourage destructive behavior. Subjected to total control and severe deprivation, individuals in solitary units are prone to act out in destructive ways, including violent outbursts, assaults against staff (Haney and Lynch 1997; Irwin 2005; Toch and Adams 2002), and self-harm (Huey and McNulty 2005; Kaba et al. 2014; Kupers 1999; Lanes 2009). In the long-run, experiences in solitary confinement has been associated with increased irritability, anger, aggression, impulsiveness, and rage, which increases the propensity for interpersonal

conflict and violence after release (Grassian 2006; Haney 2003b, 2012; Lerman 2013; Rhodes 2004). Finally, individuals may become accustomed to intense regulation of their time and behavior, and over time, experience diminished impulse-control and lose the capacity to self-regulate, which complicates adjustment to the lack of structure on the outside and increases the risk of criminal activity (Arrigo and Bullock 2007; Haney 2003b; Irwin 2005).

*Legal Cynicism*

Second, the nature of prison life can stoke and reinforce resentment, disillusionment, and sense of injustice with the criminal justice system, and harsher confinement conditions in solitary confinement may deepen anti-social attitudes and legal cynicism. Individuals may perceive the loss of privacy, being forced to live in close quarters with strangers, material deprivation, and other features of prison life as degrading and dehumanizing. Moreover, highly restrictive but arbitrarily enforced in-prison rules trigger a sense of unfairness and mistreatment (Armstrong 2015; Irwin 2005). Individuals placed in solitary are subjected to more intense control and surveillance and harsh treatment. Recreational activity, access to reading materials, vocational training, and even visitation from family and friends are severely reduced or routinely denied (ACLU 2014a; Baumgartel et al. 2015; Frost and Monteiro 2016). Moreover, because individuals are completely restricted to their cell in solitary, they are even more dependent on guards for their basic needs, which creates more power differential and opportunity for staff-on-prisoner abuse (Irwin 2005; Shaylor 1998). Once placed in solitary units, the procedures for exiting them are often complex and vague, leaving individuals with little clue of the end of their time there (Ghafar 2017). These conditions and treatment exacerbate and resentment and disillusionment with the correctional system in particular, and legal institutions in general. Such mistrust weakens adherence to social norms, which are important to preventing crime and

violence (Lerman 2013). In addition, studies suggest that perceived unfair treatment and injustice promote cynicism and depress participation in legal and other social institutions (Brayne 2014; Desmond, Papachristos, and Kirk 2016; Weaver and Lerman 2010). Ultimately, this results in further marginalization from society.

*Stigmatization*

Third, imprisonment not only influences behaviors and attitudes, but also shapes social identities. Individuals convicted of a crime bear the stigma of a criminal record, a negative credential that is exceedingly difficult to manage and nearly impossible to erase (Harding 2003; Pager 2003). For prisoners, the experience of imprisonment sends an additional signal of their diminished and diminishing social status. How individuals are treated in prison suggests their social position and worth. As Lerman (2013) argues, "through their [citizens] direct contact with criminal justice authorities and through the social provisions the state provides (or withholds) within criminal justice institutions, citizens gain an understanding of how others value (or devalue) people like them and receive signals regarding how they should value (or devalue) others" (56). The very nature of imprisonment (e.g., loss of independence, absence of privacy, material and social deprivation) and increasingly punitive treatment reinforce prisoners' social status as outsiders from the rest of society.

The kind of treatment that inmates receive in solitary confinement is one of the most restrictive and punitive forms of correctional control, and such an experience signals to inmates that they indeed are the "worst of the worst." Prisoners placed in solitary are often deemed incorrigible, dangerous, and violent, and treatment in solitary units follow accordingly. Inmates are confined for up to 24 hours a day in their cell, and all their movements are monitored closely. Interactions with other inmates and staff are restricted, and anytime they leave their cells, they

are often escorted in shackles. Such treatment coupled with antagonist interactions between individuals and prison staff entrenches an oppositional identity, or an "us against them" mentality (Lerman 2013). Whether or not individuals possess these characteristics of the "worst of the worst", treatment of contempt and hostility in solitary units almost guarantees they will develop or reinforce them (Irwin 2005). That is, individuals may come to assume such labels, which ensures a self-fulfilling prophecy of deviant behavior (Haney and Lynch 1997).

Ultimately, extreme mal-adaptations, anti-social attitudes, and identities that individuals develop in solitary confinement may become so entrenched that they are difficult to leave behind when individuals are released from prison (Haney 2017; Smith 2006).

*Incapacitation, Specific Deterrence, and Reform*

Prior research also suggests three potential processes through which imprisonment might reduce criminal behavior that can be extended to the case of solitary confinement: incapacitation, specific deterrence, and reform. First, use of imprisonment is intended to prevent crimes by incapacitation or the removal and containment of individuals from the community (Nagin et al. 2009). Incapacitation for individuals placed in solitary confinement takes two form: removal from society and isolation from the general prison population. A main argument for the use of solitary confinement is indeed this "double incapacitation" of dangerous individuals to protect other inmates and prison staff, and the rest of society (Pizarro and Narag 2008:24; Smith 2006). Moreover, individuals held in long-term isolation are often not eligible to receive good-time credits, thereby prolonging their prison sentence – and the duration of incapacitation (Irwin 2005:118). Second, imprisonment is premised on the idea of specific deterrence, or the expectation that the severity of the experience in prison changes individuals' calculation of risks and rewards with regard to future criminal activity, where risks are weighted more heavily

(Nagin et al. 2009). It follows that experiences in solitary confinement, one of the harshest form of imprisonment, would produce greater reductions in future criminal behavior, relative to individuals held in the general prison population. Finally, isolation potentially contributes to the reform of individuals by removing individuals from negative peer influence (disrupting the learning of criminal activity, or "schools of crime") and providing an opportunity for introspection, to reflect on wrongdoings, and to consider pro-social norms (such as right vs. wrong) (Mears and Bales 2009; Valera and Kates-Benman 2016).[7] Together, these theories suggest that solitary confinement would enhance the crime prevention effect of imprisonment.

*Prior Empirical Studies*

To date, there have been very few studies of the long-term impacts of solitary confinement on recidivism. Research on higher prison security levels suggests harsher conditions increases reoffending. For example, two studies have leveraged discontinuities in scores that are used to assign prisoners to different facility security levels as an exogenous source of variation in harshness. Both find that all else equal, being placed in higher security conditions increases recidivism after release from prison (Chen and Shapiro 2007; Lerman 2013). Moreover, Drago and colleagues (2011), who define harshness in terms of inmate overcrowding and number of deaths in the facility, also find that harsher conditions exacerbate recidivism. Two key studies on supermax inmates (the highest security classification, where most inmates are confined in solitary units) offer important insights: Lovell and colleagues (2007) matched 200 supermax inmates to non-supermax inmates released in 1997 and 1998 in Washington state. Overall, they found no significant differences in recidivism rates, but they do observe that inmates who are

[7] The earliest use of solitary confinement in the Eastern Pennsylvania Penitentiary was premised on the isolation of individuals allow time for reflection and penitence (Reiter 2017).

directly released from supermax (rather than spending some time in a non-supermax unit prior to release) are more likely to have a felony conviction compared to the control group. Building on these findings, Mears and Bales (2009) leveraged a larger sample and more extensive controls from a sample of 1,247 supermax inmates matched to non-supermax inmates released between 1996 and 2001 in Florida. They similarly found no significant effect of supermax on recidivism overall, nor do they find an effect of recency or length of exposure. However, they found some evidence of a positive effect on new violent felony convictions. The present study builds on prior research by evaluating theoretical arguments regarding the impacts of solitary confinement on future criminal justice involvement after release.

Based on the theories discussed above, it is possible to generate hypotheses regarding the impacts of solitary confinement on the likelihood of a new felony conviction and prison admission. According to theories of prisonization, legal cynicism, and stigmatization, solitary confinement is expected to increase the probability of a new felony conviction, and specifically convictions for violent crimes. In addition, theories also suggest that solitary confinement elevates the likelihood of a subsequent prison admission, both because of failures to comply with conditions of parole supervision and because of sentences for serious and violent crimes. On the other hand, theories of specific deterrence and reform suggests a reduction in crimes and involvement with the prison system after release. Both perspectives suggest that larger effects (negative and positive, respectively) with more time spent in solitary confinement.

## Data and Methods

This study draws on administrative data from the Michigan Department of Corrections (MDOC) on all individuals convicted of a new felony and sentenced between January 1, 2003 to December 31, 2006 (N=140,267), and followed through the end of 2013. The analytic sample

(N=24,513) consists of all individuals who were originally sentenced to prison during the four-year baseline period.

*Treatment*

Exposure to solitary confinement is defined as placement in segregation units for any reason (administrative, punitive, temporary, and protective) for at least one day (N=8,735) at any point after during the observation period. Movements in the correctional system were drawn from MDOC administrative databases, including type of cell assignment, dates of movements, and subsequent prison admissions.

*Outcomes*

The first set of outcomes is drawn from court records that identify any new felony convictions after release from prison. I also examine new felony convictions for violent crimes, which are crime against persons. The second set of outcomes is drawn from MDOC's database of prison admissions, including those for a parole technical violation and for a new felony sentence. All outcomes are measured at three time points after release from prison to assess the consistency of results over time: 1, 3, and 5 years. Summary statistics of outcomes are reported in Supplemental Table B-S1.

*Controls*

Information on baseline factors and prison cell movements were draw from Pre-Sentence Information (PSI) reports and MDOC's databases. Demographic characteristics include race (non-white, white), age at sentencing (14-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51+), gender, marital status (single, non-single), known homosexual, and educational attainment (less than high school, GED equivalent, high school, and more than high school). Self-reported health

measures include history of mental illness, physical disability, health insurance, body mass index (BMI) calculated from height and weight (underweight, normal, overweight, and obese), and substance use history (alcohol, marijuana, stimulants, opioids, and other drugs). The PSI reports also provided data on criminal history, including prior felony convictions and the number of prior adult jail, prison, and probation commitments. Prior number of arrests (0-4, 5-9, and 10 or more) were drawn the Michigan State Police. Statistical risk assessments of assaultive risk and property damage were extracted from the MDOC databases. Assaultive risk (low, middle, and high) is scored based on the type of crime individuals are sentenced (i.e., robbery, sexual assault, murder, or any assaultive felony), first arrest before the age of 15, prior serious institutional misconduct in prison, reported history of juvenile felony, and whether individuals were ever married. Property risk (low, middle, and high) is based on reported history of juvenile history, prior serious institutional misconduct in prison, first arrest before the age of 15, and history of drug abuse. Information on the focal sentence (the original sentence that entered individuals into the study between 2003 and 2006) include the type of crime (controlled substance, violent, property, public order, and public safety), total offense severity score based on the sentencing guidelines, and length of prison sentence. Summary statistics of covariates are reported for the overall sample and by treatment in Supplemental Table B-S2. Summary statistics for each type of isolation are reported in Supplemental Table B-S3.

*Inverse Probability of Treatment Weighting (IPTW)*

A key challenge to estimating the impact of solitary confinement on future criminal justice involvement is the concern of potential confounding. Solitary confinement is a highly selective experience that makes it difficult to separate cause and effect. Factors that are correlated with propensity to be sent to solitary are also likely correlated with reoffending

outcomes, including criminal history, age, substance, and in-prison misconduct. To improve causal inference, the study employs inverse probability of treating weighting (IPTW) regression models (Austin and Stuart 2015). These models create more appropriate counterfactuals by generating more balanced comparisons with regard to probability of treatment. Individuals less likely to receive treatment are weighted more in the analysis, while those more likely are weighted less to achieve balanced comparisons. Likelihood of treatment is generated from a logistic regression of ever in solitary confinement on a vector of covariates predictive of treatment, including demographic factors, substance use history, criminal justice involvement history, and sentencing characteristics related to the original felony conviction (results reported in Supplemental Table B-S4). The advantage of IPTW over other propensity score methods (such as matching) is that it is able to retain all observations in the analysis (rather than dropping cases due to poor matching, for example). Moreover, in this analysis, the IPTW method generated more balanced covariates compared to matching methods. I also tested the sensitivity of results to several methods, including IPTW, doubly robust IPTW, and propensity score matching (shown in Supplemental Table B-S5). Results are consistent across specifications. Finally, one potential problem with the use of IPTW is that estimates may be sensitive to very large (or very small) generated weights. To assess the sensitivity of results to this potential problem, I truncated weights to the $5^{th}$ and $95^{th}$ percentile and re-estimated the models. Results (not shown) did not significantly change.

Conditional on the propensity score, the distribution of covariates is assumed to be independent of treatment status (Austin 2011; Austin and Stuart 2015). One method to assess covariate balance is to compare means or proportions and variance of covariates between untreated and treated subjects. Supplemental Table B-S6 shows standardized differences and

variances of key covariates. Standardized differences closer to 0 and standardized variances closer to 1 indicate better balance. Across all covariates, standardized means and variances are generally close to 0 and 1, respectively – indicating balance among matched subjects. One key requirement of inverse probability of treatment weighting models is sufficient overlap in propensity scores between treated and untreated individuals (specifically, that probability of treatment is non-zero for all subjects). To assess whether there is sufficient overlap, I examine the distribution of propensity scores for untreated and treated subjects. One should expect to see greater densities of subjects in the region of common support rather than mass points near 0 or 1 (which suggests poor matches). Figure B-S1 indicates sufficient overlap of propensity scores.

I also conduct several supplemental analyses to test the sensitivity of findings. First, I examine differences in effects by length of exposure. This allows an opportunity to evaluate several potential mechanisms. Second, I explore variation in effects by whether individuals were convicted of a violent crime at baseline in order to investigate whether solitary confinement increases offending even among non-violent offenders. Finally, I also test the sensitivity of results to the incapacitation of individuals who experienced solitary confinement but were not released from prison during the observation period.

## Results

*Summary Statistics*

I begin by summarizing exposures to solitary confinement (the treatment). Table B-1 reports summary statistics for the full sample and separately for the treatment group. More than a third (36%) of the sample experienced some form of solitary confinement during the study period. Among the overall sample, the average cumulative number of days spent in solitary was 55 days. For the treatment group, the average was 155 days. Finally, the average number of trips

to solitary was 2.3 for the overall sample and 6.4 for the treatment group. Overall, these summary statistics indicate that the likelihood of treatment is common, the duration of exposure is lengthy, and the frequency of stays is high.

*[Table B-1 about here]*

Next I turn to summarizing outcome measures. Figure B-1 plots unconditional rates of (A) any felony conviction and (B) any violent felony conviction after release from prison. Rates are reported by years since release and for the treatment (black line) and control (gray line) groups. Across all time periods, rates are substantially higher for individuals in the treatment group for both conviction outcomes. For example, within three years from release, 42% of individuals who were ever in solitary confinement were convicted of a felony compared to 21% of the control group, a difference of 21 percentage points. For the same period, 16% of the treatment group were convicted of a violent felony compared to 5% of the control group. The gap in rates between the treatment and control groups also grows larger over time. By five years after release, there is a difference of 27 percentage points for any felony conviction and 15 percentage points for a violent felony conviction.

*[Figure B-1 about here]*

Next, I examine rates of three related imprisonment outcomes in Figure B-2: (A) any imprisonment, (B) imprisonment for a technical violation, and (C) imprisonment for a new sentence. Across these outcomes, rates for the treatment group are also considerably higher than the control group. For example, within three years from release, 51% of the treatment group were admitted to prison for any reason compared to 25% of the control group. Higher rates in the treatment group are reflected for both prison admissions for a technical violation and new

sentence. Differences in rates over time appear to grow larger as a result of higher rates of imprisonment for a new sentence in the treatment group. Together, these figures indicate that individuals who experience solitary confinement have higher levels of involvement with the criminal justice system after release from prison.

*[Figure B-2 about here]*

*Main Results*

Table B-2 presents IPW estimates of the effect of solitary confinement, baseline rates for the control group, and ratios of IPW estimates to baseline rates. Estimates and rates are reported for five outcomes and for three time points (1, 3, 5 years) after release from prison. First, estimates indicate that solitary confinement significantly increases the likelihood of a felony conviction of any crime and a violent felony conviction across all three time points. For instance, within three years after release, solitary confinement increases the probability of being convicted for a felony of any crime by 18.2 percentage points and for a violent felony by 9.8 percentage points. To evaluate the relative magnitude of these effects, we can interpret them as the percent change from the baseline rate for the control group. Effects for the three-year period represent an 86% increase in any felony convictions and a 192% increase in violent felony convictions. The dramatic effect on violent felony convictions reflects in part relatively low rates in the control group. For instance, the rate of violent felony conviction for the treatment group would be 15% compared to 5% for the reference group.

*[Table B-2 about here]*

Next, we examine estimates for three related imprisonment outcomes: imprisonment for any reason, imprisonment for a technical violation, and imprisonment for a new sentence. Across

all time periods and for all three outcomes, estimates indicate that solitary confinement significantly increases the probability of subsequent imprisonment after release. Within three years after release, solitary confinement increases the likelihood of imprisonment for any reason by 21.6 percentage points (or 88% increase from the baseline rate), imprisonment for a technical violation by 9.4 percentage points (64% increase), and imprisonment for a new sentence by 15 percentage points (132% increase). While the effect on technical violation (5.9 percentage points) is larger than the effect on new sentence (4.4 percentage points) at the one-year mark, over time the effect on new sentence becomes much larger, indicating that high rates of imprisonment further out from release is driven in large part by prison sentences for new crimes. This is consistent with the findings on increased violent felony convictions, which are likely to carry a prison sentence. Taken together, estimates on felony convictions and imprisonment provide strong and consistent evidence to suggest that solitary confinement increases future involvement with the criminal justice system.

*Sensitivity Analyses*

I discuss three additional analyses that evaluate the sensitivity of findings to the length of exposure, differences between violent and non-violent individuals, and inclusion of individuals who experienced solitary confinement but were not released during the study period. First, I examine variation in effects by length of exposure to further evaluate potential mechanisms. On the one hand, negative behavioral adaptations (prisonization) and adoption of anti-social attitudes (legal cynicism) may worsen and become more entrenched with more time spent in solitary confinement. On the other hand, effects as a result of stigmatization and impacts on social identity are likely to be stable regardless of exposure length. Table B-2 reports estimates for three lengths of exposure: at least one week, at least one month, and at least six months in

solitary. For felony conviction outcomes, effects generally are larger with longer exposures. For example, within three years from release, solitary confinement increases the probability of a felony conviction by 11.2 percentage for those who spent at least one week in solitary, 13.6 percentage points for at least one month, and 17.4 percentage points for at least six months. Effects on imprisonment outcomes are less consistent and even appear to decline with more time in solitary confinement. This, however, is the product of countervailing trends on imprisonment for technical violations (declines with more time) and new sentences (increases with more time). Imprisonment for technical violations and imprisonment for new sentences may represent competing risks since individuals are not likely to have numerous imprisonment spells during the follow up period.[8] Moreover, larger effects on imprisonment for a new sentence are consistent with estimates for a violent felony conviction, which are likely to carry a prison sentence. Taken together, these results indicate that while the shortest length of time in solitary confinement yields large positive effects, longer lengths generally produce even larger effects.

*[Table B-3 about here]*

Second, one set of theories argues that solitary confinement is criminogenic because of negative behavioral adaptations that encourage and normalize anti-social and violent behavior. The current results indicate that indeed solitary confinement increases the probability of future criminal justice involvement, including a violent felony conviction. To further investigate this hypothesis, I examine variation in the effect of solitary confinement by whether individuals were convicted of a violent crime at baseline. If solitary confinement leads to subsequent violent

[8] One surprising finding is that the effects on imprisonment for a technical violation is negative (though not significant) within five years after release. One possible explanation is that individuals who spend six months or more in solitary confinement may serve the full term of their prison sentence ("max out") and as a result are discharged without parole. This would effectively reduce their risk of imprisonment for a technical violation.

behavior even among non-violent individuals, this would provide further evidence to support the view that solitary confinement encourages violent behavior, and thereby threatens public safety. Table B-3 reports estimates from models stratified by whether individuals were convicted of a violent crime at baseline. I find positive and significant effects for both groups. More specifically, the effects on violent felony conviction is comparable for violent and non-violent individuals. I interpret these results to mean that solitary confinement increases the likelihood of violent criminal behavior not only among individuals who were already at-risk (convicted of violent crimes at baseline) but also among those not previously convicted of a violent crime.

*[Table B-4 about here]*

Third, I examine the sensitivity of results to the incapacitation of individuals who experienced solitary confinement but were not released from prison during the observation period.[9] To empirically evaluate how incapacitation might impact results, I incorporate individuals who experienced solitary confinement and were never released from prison into the analysis by setting their values on observed outcomes to zero (rather than missing). These individuals were excluded from the analysis because they are, by definition, not at risk of offending in the community while they are in prison. However, one key argument for the use of solitary confinement is the removal of potential criminal threat by keeping individuals in custody. Moreover, solitary confinement may prolong the time individuals are in prison (via the denial of parole, for example). Indeed, in a supplementary analysis presented in Table B-S7, I tested whether exposure to solitary confinement increases the likelihood of being held in custody beyond the minimum prison sentence and found a significant positive relationship. As such,

[9] Given the "double incapacitation" of solitary confinement, impacts on infractions, misconducts, and violence while in custody may also be of interest. Research suggests that infractions and misbehavior – including assaults on staff – may actually increase in solitary units (Briggs et al. 2003; Irwin 2005; Toch and Adams 2002).

results reported in Table B-1 may understate the crime prevention function of solitary confinement. If the main results are entirely driven by incapacitation, one would expect estimates to be negative or zero. Table B-4 reports estimates from models that include individuals not released. While point estimates are smaller than those reported for the main models in Table B-1, across all outcomes and time periods, effects remain positive and statistically significant. This indicates that the crime suppressing effect of incapacitation is not enough to overcome the substantial criminogenic effect of solitary confinement.

*[Table B-5 about here]*

## Conclusion

The study investigates the long-term consequences of solitary confinement on future criminal justice involvement – future felony convictions and prison admissions – after release from prison. Leveraging administrative data on a cohort of prisoners in the state of Michigan and employing inverse probability of treatment weighting regression, I find that solitary confinement significantly increases the likelihood of being convicted of a felony and of returning to prison. Results indicate these effects are driven in large part by convictions for violent crimes, which are likely to result in a new prison sentence. Additional results also demonstrate that effects increase with duration in solitary and that exposure results to increased reoffending and imprisonment for both individuals who were previously convicted of a violent crime – and those who were not. Findings together suggest that the experience of solitary confinement is associated with strong criminogenic effects, and as a result poses a potential significant threat to public safety in the long run.

Findings from the study have several important theoretical implications. First, they offer evidence that confinement conditions have significant impacts on future individual outcomes.

That is, the particular conditions of confinement matter in assessing the consequences of imprisonment. In this case, solitary confinement can intensify the negative (crime-inducing) impacts of imprisonment. Second, findings underscore the importance of attending to the long-term consequences of exposure to solitary confinement, not just the immediate time when individuals are held in such units. The consequences of solitary confinement indeed may be lasting. Third, evidence that solitary confinement is specifically related to future (violent) criminal behavior is consistent with theories of prisonization, legal cynicism, and stigmatization, which suggests extreme mal-adaptations, anti-social attitudes, and identities associated with exposure that become so entrenched that they impede individuals' transition and reintegration into society – and desistance. Finally, findings further question the logic of specific deterrence – the notion that delivering harsher punishments necessarily leads to greater crime prevention. In fact, the most extreme punishments may very well produce the opposite of their intended impact.

There is now consistent evidence that solitary confinement does not achieve its immediate and intended aim to reduce misconducts and infractions in prison (Briggs et al. 2003; Labrecque 2015; Lucas and Jones 2017; Morris 2016). This evidence, coupled with the long-term counterproductive effects identified in this study, raises further question regarding the use of solitary confinement as a long-term strategy of inmate management. Indeed, the fiscal costs of operating these units are extraordinary (double or triple the costs of regular units), and there is mounting evidence of deleterious collateral consequences on mental health and well-being (Arrigo and Bullock 2007; Cloud et al. 2015; Grassian 2006; Haney 2003a; Kaba et al. 2014; Kupers 1999). In light of this evidence, it is necessary to reconsider and reevaluate the long-term use of solitary confinement.

Finally, I reminder readers of the limitations of this study. First, it is based in one state, and policies and practices of solitary confinement may vary significantly across justifications. Caution should be exercised in generalizing findings to other contexts. Second, inverse probability of treatment weighting does not address potential unobserved confounding. Future work should explore alternative strategies to address such threats to causal inference. Third, the study does not observe "less severe" forms of criminal justice contact, such as arrests. As a result, this study may under-estimate the extent of future criminal justice involvement. Finally, the sample includes isolation experiences only in prison settings and not jail, which may have importance differences and warrants further investigation (Haney et al. 2016).

## Figures

Figure B-1. Rates of New Felony Conviction after Release from Prison, by Treatment Status

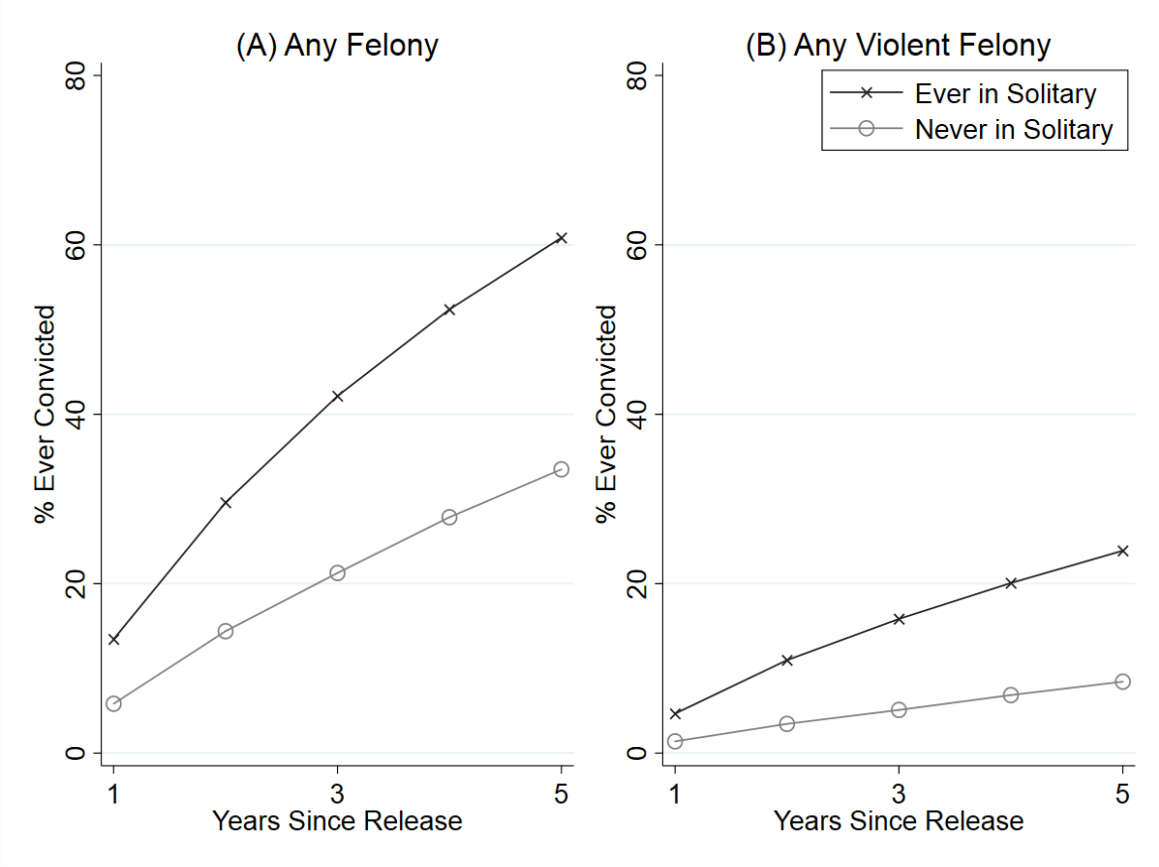


Figure B-2. Rates of Returning to Prison after Release, by Treatment Status

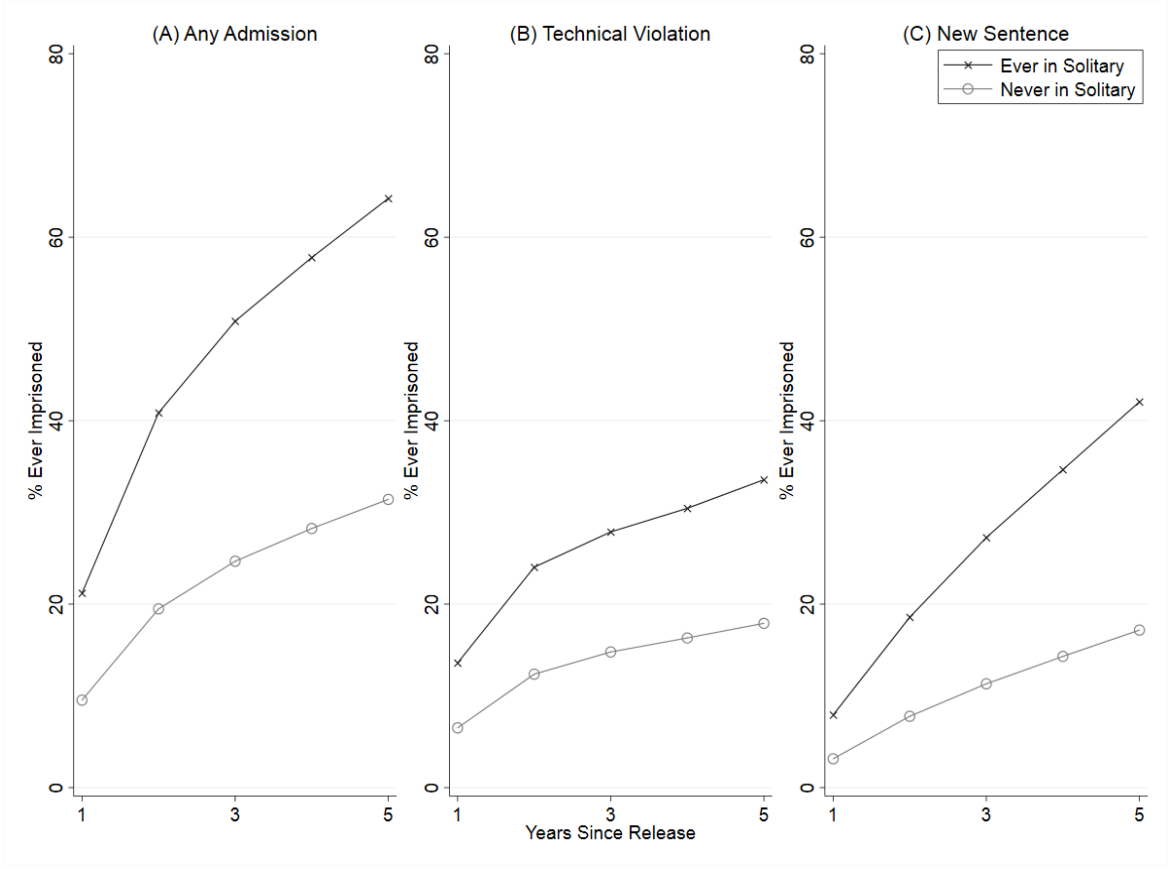
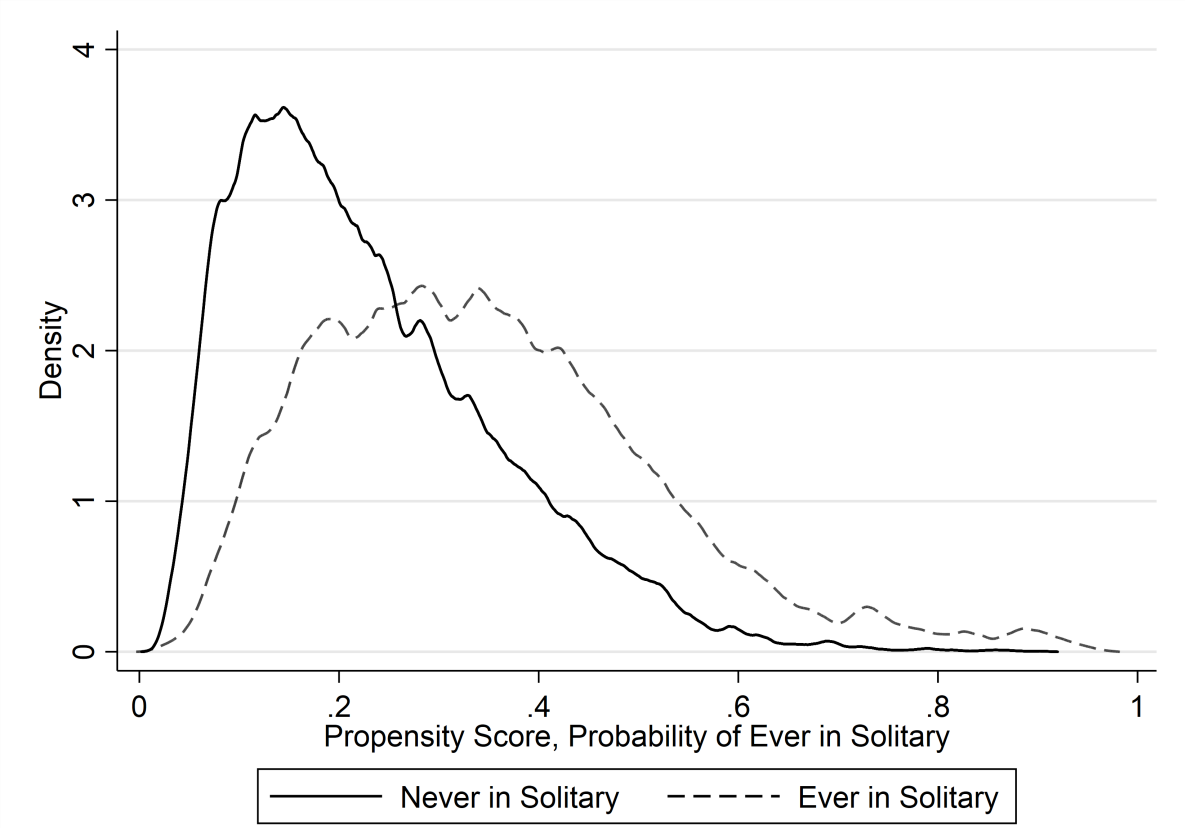


Figure B-S1. Distribution of Propensity Scores, by Treatment Status



## Tables

Table B-1. Summary Statistics of Treatment

| | Full Sample | | Any Solitary Confinement | |
|---|---|---|---|---|
| | Mean / % | SD | Mean / % | SD |
| Proportion of Sample in Solitary Confinement | 0.36 | 0.48 | - | - |
| Cumulative Days in Solitary Confinement | 55.11 | 216.17 | 154.64 | 340.22 |
| Number of Trips to Solitary Confinement | 2.29 | 6.36 | 6.42 | 9.33 |
| Observations | 24,513 | | 8,735 | |

Table B-2. Effects of Solitary Confinement on Future Criminal Justice Involvement after Release from Prison, Inverse Probability of Treatment Weighting (IPTW) Estimates

| | IPTW | | Baseline Rate | |
|---|---|---|---|---|
| | b | se | rate | % of rate |
| *A. Ever Convicted of a Felony* | | | | |
| Within 1 year | 0.068*** | (0.006) | 0.06 | 117% |
| Within 3 years | 0.182*** | (0.009) | 0.21 | 86% |
| Within 5 years | 0.220*** | (0.010) | 0.33 | 66% |
| *B. Ever Convicted of a Violent Felony* | | | | |
| Within 1 year | 0.030*** | (0.003) | 0.01 | 217% |
| Within 3 years | 0.098*** | (0.006) | 0.05 | 192% |
| Within 5 years | 0.134*** | (0.008) | 0.08 | 159% |
| *C. Ever Imprisoned for Any Reason* | | | | |
| Within 1 year | 0.101*** | (0.007) | 0.10 | 106% |
| Within 3 years | 0.216*** | (0.009) | 0.25 | 88% |
| Within 5 years | 0.260*** | (0.010) | 0.31 | 83% |
| *D. Ever Imprisoned for a Technical Violation* | | | | |
| Within 1 year | 0.059*** | (0.006) | 0.07 | 91% |
| Within 3 years | 0.094*** | (0.008) | 0.15 | 64% |
| Within 5 years | 0.108*** | (0.010) | 0.18 | 60% |
| *E. Ever Imprisoned for a New Sentence* | | | | |
| Within 1 year | 0.044*** | (0.004) | 0.03 | 140% |
| Within 3 years | 0.150*** | (0.007) | 0.11 | 132% |
| Within 5 years | 0.222*** | (0.009) | 0.17 | 129% |

Note: b = treatment effect, se = standard error. Baseline rates represent unconditional rates for the untreated group.
*** p<0.001, ** p<0.01, * p<0.05

Table B-3. Effects of Solitary Confinement on Future Criminal Justice Involvement after Release from Prison, Stratified by Cumulative Time in Solitary Confinement

| | At Least 1 Week in Solitary | | At Least 1 Month in Solitary | | At Least 6 Months in Solitary | |
|---|---|---|---|---|---|---|
| | b | se | b | se | b | se |
| *A. Ever Convicted of a Felony* | | | | | | |
| Within 1 year | 0.065*** | (0.007) | 0.074*** | (0.009) | 0.101*** | (0.017) |
| Within 3 years | 0.189*** | (0.010) | 0.204*** | (0.013) | 0.245*** | (0.023) |
| Within 5 years | 0.231*** | (0.012) | 0.242*** | (0.015) | 0.284*** | (0.025) |
| *B. Ever Convicted of a Violent Felony* | | | | | | |
| Within 1 year | 0.033*** | (0.004) | 0.033*** | (0.005) | 0.054*** | (0.011) |
| Within 3 years | 0.112*** | (0.007) | 0.136*** | (0.010) | 0.174*** | (0.019) |
| Within 5 years | 0.150*** | (0.009) | 0.178*** | (0.013) | 0.232*** | (0.024) |
| *C. Ever Imprisoned for Any Reason* | | | | | | |
| Within 1 year | 0.097*** | (0.008) | 0.103*** | (0.010) | 0.096*** | (0.018) |
| Within 3 years | 0.215*** | (0.010) | 0.212*** | (0.012) | 0.205*** | (0.022) |
| Within 5 years | 0.257*** | (0.011) | 0.246*** | (0.013) | 0.219*** | (0.024) |
| *D. Ever Imprisoned for a Technical Violation* | | | | | | |
| Within 1 year | 0.056*** | (0.007) | 0.052*** | (0.009) | 0.034** | (0.015) |
| Within 3 years | 0.090*** | (0.009) | 0.063*** | (0.012) | 0.011 | (0.021) |
| Within 5 years | 0.097*** | (0.011) | 0.066*** | (0.015) | -0.013 | (0.026) |
| *E. Ever Imprisoned for a New Sentence* | | | | | | |
| Within 1 year | 0.044*** | (0.005) | 0.056*** | (0.007) | 0.070*** | (0.013) |
| Within 3 years | 0.152*** | (0.009) | 0.172*** | (0.012) | 0.207*** | (0.022) |
| Within 5 years | 0.226*** | (0.011) | 0.240*** | (0.015) | 0.244*** | (0.026) |

Note: estimates from inverse probability of treatment weighting (IPTW) models, b = treatment effect, se = standard error.

*** p<0.001, ** p<0.01, * p<0.05

Table B-4. Effects of Solitary Confinement on Future Criminal Justice Involvement after Release from Prison, Stratified by Non-Violent and Violent Focal Conviction

| | Non-Violent | | Violent | |
|---|---|---|---|---|
| | b | se | b | se |
| *A. Ever Convicted of a Felony* | | | | |
| Within 1 year | 0.084*** | (0.009) | 0.052*** | (0.007) |
| Within 3 years | 0.201*** | (0.013) | 0.158*** | (0.012) |
| Within 5 years | 0.231*** | (0.013) | 0.200*** | (0.016) |
| *B. Ever Convicted of a Violent Felony* | | | | |
| Within 1 year | 0.032*** | (0.005) | 0.028*** | (0.004) |
| Within 3 years | 0.100*** | (0.009) | 0.094*** | (0.008) |
| Within 5 years | 0.123*** | (0.010) | 0.144*** | (0.011) |
| *C. Ever Imprisoned for Any Reason* | | | | |
| Within 1 year | 0.121*** | (0.011) | 0.085*** | (0.009) |
| Within 3 years | 0.249*** | (0.012) | 0.185*** | (0.012) |
| Within 5 years | 0.279*** | (0.012) | 0.237*** | (0.014) |
| *D. Ever Imprisoned for a Technical Violation* | | | | |
| Within 1 year | 0.062*** | (0.009) | 0.058*** | (0.007) |
| Within 3 years | 0.110*** | (0.012) | 0.084*** | (0.011) |
| Within 5 years | 0.129*** | (0.013) | 0.088*** | (0.014) |
| *E. Ever Imprisoned for a New Sentence* | | | | |
| Within 1 year | 0.062*** | (0.008) | 0.028*** | (0.005) |
| Within 3 years | 0.179*** | (0.012) | 0.116*** | (0.010) |
| Within 5 years | 0.240*** | (0.013) | 0.194*** | (0.013) |

Note: estimates from inverse probability of treatment weighting (IPTW) models, b = treatment effect, se = standard error.
*** p<0.001, ** p<0.01, * p<0.05

Table B-5. Effects of Solitary Confinement on Future Criminal Justice Involvement after Release from Prison, Test of Incapacitation

| | | IPTW | |
|---|---|---|---|
| | | b | se |
| *A. Ever Convicted of a Felony* | | | |
| | Within 1 year | 0.057*** | (0.006) |
| | Within 3 years | 0.133*** | (0.009) |
| | Within 5 years | 0.145*** | (0.012) |
| *B. Ever Convicted of a Violent Felony* | | | |
| | Within 1 year | 0.023*** | (0.003) |
| | Within 3 years | 0.070*** | (0.006) |
| | Within 5 years | 0.092*** | (0.007) |
| *C. Ever Imprisoned for Any Reason* | | | |
| | Within 1 year | 0.077*** | (0.007) |
| | Within 3 years | 0.154*** | (0.009) |
| | Within 5 years | 0.182*** | (0.011) |
| *D. Ever Imprisoned for a Technical Violation* | | | |
| | Within 1 year | 0.043*** | (0.006) |
| | Within 3 years | 0.065*** | (0.008) |
| | Within 5 years | 0.075*** | (0.010) |
| *E. Ever Imprisoned for a New Sentence* | | | |
| | Within 1 year | 0.036*** | (0.004) |
| | Within 3 years | 0.111*** | (0.007) |
| | Within 5 years | 0.164*** | (0.010) |

Note: IPTW = inverse probability of treatment weighting, b = treatment effect, se = standard error. Individuals who experienced solitary confinement but were not released during the observation period were retained in the analysis by setting their outcomes to zero (rather than missing).

*** p<0.001, ** p<0.01, * p<0.05

Table B-S1. Summary Statistics of Outcomes

| | Overall | | Any Solitary | | No Solitary | |
|---|---|---|---|---|---|---|
| | % | SD | % | SD | % | SD |
| *A. Ever Convicted of a Felony* | | | | | | |
| Within 1 year | 0.08 | 0.27 | 0.13 | 0.34 | 0.06 | 0.23 |
| Within 3 years | 0.27 | 0.44 | 0.42 | 0.49 | 0.21 | 0.41 |
| Within 5 years | 0.40 | 0.49 | 0.61 | 0.49 | 0.33 | 0.47 |
| *B. Ever Convicted of a Violent Felony* | | | | | | |
| Within 1 year | 0.02 | 0.15 | 0.05 | 0.21 | 0.01 | 0.12 |
| Within 3 years | 0.08 | 0.27 | 0.16 | 0.37 | 0.05 | 0.22 |
| Within 5 years | 0.12 | 0.33 | 0.24 | 0.43 | 0.08 | 0.28 |
| *C. Ever Imprisoned for Any Reason* | | | | | | |
| Within 1 year | 0.13 | 0.34 | 0.21 | 0.41 | 0.10 | 0.29 |
| Within 3 years | 0.32 | 0.47 | 0.51 | 0.50 | 0.25 | 0.43 |
| Within 5 years | 0.39 | 0.49 | 0.64 | 0.48 | 0.31 | 0.46 |
| *D. Ever Imprisoned for a Technical Violation* | | | | | | |
| Within 1 year | 0.09 | 0.28 | 0.14 | 0.34 | 0.07 | 0.25 |
| Within 3 years | 0.18 | 0.39 | 0.28 | 0.45 | 0.15 | 0.36 |
| Within 5 years | 0.22 | 0.41 | 0.34 | 0.47 | 0.18 | 0.38 |
| *E. Ever Imprisoned for a New Sentence* | | | | | | |
| Within 1 year | 0.05 | 0.21 | 0.08 | 0.27 | 0.03 | 0.17 |
| Within 3 years | 0.16 | 0.36 | 0.27 | 0.45 | 0.11 | 0.32 |
| Within 5 years | 0.23 | 0.42 | 0.42 | 0.49 | 0.17 | 0.38 |
| Observations | 24,513 | | 8,735 (35.6%) | | 15,778 (64.4%) | |

Table B-S2. Summary Statistics of Covariates

| | Full Sample | | Ever in Solitary Confinement | | Never in Solitary Confinement | |
|---|---|---|---|---|---|---|
| | Mean / % | SD | Mean / % | SD | Mean / % | SD |
| *Demographic Characteristics* | | | | | | |
| Non-White | 0.45 | 0.50 | 0.49 | 0.50 | 0.43 | 0.49 |
| Female | 0.06 | 0.24 | 0.06 | 0.24 | 0.06 | 0.24 |
| Age at Sentence | 33.49 | 10.56 | 30.94 | 10.11 | 34.90 | 10.53 |
| Single | 0.65 | 0.48 | 0.73 | 0.45 | 0.61 | 0.49 |
| Known Homosexual | 0.01 | 0.09 | 0.01 | 0.11 | 0.01 | 0.08 |
| *Human Capital* | | | | | | |
| Less than HS | 0.41 | 0.49 | 0.46 | 0.50 | 0.39 | 0.49 |
| GED | 0.23 | 0.42 | 0.24 | 0.43 | 0.22 | 0.41 |
| HS | 0.29 | 0.45 | 0.24 | 0.43 | 0.31 | 0.46 |
| More than HS | 0.07 | 0.26 | 0.06 | 0.23 | 0.08 | 0.28 |
| Pre-Sentence Employment | 0.29 | 0.28 | 0.23 | 0.25 | 0.33 | 0.29 |
| *Health and Substance Abuse* | | | | | | |
| History of Mental Illness | 0.19 | 0.39 | 0.23 | 0.42 | 0.17 | 0.38 |
| Underweight | 0.01 | 0.09 | 0.01 | 0.10 | 0.01 | 0.08 |
| Normal Weight | 0.41 | 0.49 | 0.42 | 0.49 | 0.41 | 0.49 |
| Overweight | 0.39 | 0.49 | 0.38 | 0.49 | 0.40 | 0.49 |
| Obese | 0.19 | 0.39 | 0.18 | 0.39 | 0.19 | 0.39 |
| History of Alcohol use | 0.66 | 0.47 | 0.63 | 0.48 | 0.68 | 0.47 |
| History of Marijuana Use | 0.62 | 0.49 | 0.63 | 0.48 | 0.61 | 0.49 |
| History of Stimulants Use | 0.40 | 0.49 | 0.38 | 0.49 | 0.42 | 0.49 |
| History of Opioids Use | 0.14 | 0.34 | 0.14 | 0.34 | 0.14 | 0.34 |
| History of Other Drug Use | 0.28 | 0.45 | 0.31 | 0.46 | 0.26 | 0.44 |
| Health Insurance at Sentencing | 0.19 | 0.39 | 0.17 | 0.38 | 0.19 | 0.40 |
| Physical Disability | 0.38 | 0.48 | 0.36 | 0.48 | 0.39 | 0.49 |
| *Criminal History* | | | | | | |
| 0-4 Prior Arrests | 0.24 | 0.43 | 0.24 | 0.43 | 2.59 | 3.22 |
| 5-9 Prior Arrests | 0.30 | 0.46 | 0.30 | 0.46 | 0.24 | 0.43 |
| 10+ Prior Arrests | 0.46 | 0.50 | 0.46 | 0.50 | 0.30 | 0.46 |
| Prior Felony Convictions | 2.57 | 3.29 | 2.53 | 3.42 | 0.46 | 0.50 |
| Prior Adult Jail Commitments | 2.97 | 3.98 | 2.81 | 3.95 | 3.06 | 3.99 |
| Prior Adult Prison Commitments | 1.31 | 1.90 | 1.37 | 2.07 | 1.28 | 1.80 |
| Prior Adult Probation Commitments | 1.83 | 2.02 | 1.64 | 1.88 | 1.93 | 2.09 |
| Prior Months in Prison | 29.94 | 48.49 | 34.63 | 52.77 | 27.35 | 45.74 |
| Prior In-Prison Violent Misconduct | 0.17 | 0.38 | 0.25 | 0.43 | 0.13 | 0.33 |
| Prior In-Prison Drug Misconduct | 0.16 | 0.37 | 0.18 | 0.39 | 0.15 | 0.36 |
| Prior In-Prison Contraband Misconduct | 0.15 | 0.36 | 0.21 | 0.41 | 0.12 | 0.33 |
| Prior In-Prison Disobeying Misconduct | 0.33 | 0.47 | 0.39 | 0.49 | 0.29 | 0.45 |
| *Statistical Risk Assessments* | | | | | | |
| Low Assault Risk | 0.44 | 0.50 | 0.31 | 0.46 | 0.51 | 0.50 |
| Middle Assault Risk | 0.52 | 0.50 | 0.62 | 0.49 | 0.47 | 0.50 |
| High Assault Risk | 0.04 | 0.20 | 0.08 | 0.27 | 0.02 | 0.15 |
| Low Property Risk | 0.41 | 0.49 | 0.34 | 0.47 | 0.44 | 0.50 |
| Middle Property Risk | 0.39 | 0.49 | 0.37 | 0.48 | 0.40 | 0.49 |
| High Property Risk | 0.21 | 0.40 | 0.29 | 0.46 | 0.16 | 0.36 |
| *Sentencing Factors* | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Controlled Substance Crime | 0.15 | 0.36 | 0.09 | 0.29 | 0.18 | 0.39 |
| Violent Crime | 0.51 | 0.50 | 0.62 | 0.49 | 0.45 | 0.50 |
| Property Crime | 0.18 | 0.38 | 0.16 | 0.37 | 0.19 | 0.39 |
| Public Order Crime | 0.02 | 0.15 | 0.02 | 0.13 | 0.03 | 0.17 |
| Public Safety Crime | 0.13 | 0.34 | 0.11 | 0.32 | 0.14 | 0.35 |
| Total Offense Severity Score | 33.09 | 33.46 | 40.47 | 38.17 | 29.01 | 29.76 |
| Violent Offense in Sentence Cluster | 0.56 | 0.50 | 0.67 | 0.47 | 0.50 | 0.50 |
| Length of Prison Sentence | 47.12 | 65.69 | 68.38 | 89.61 | 35.36 | 43.25 |
| Observations | 24,513 | | 8,735 (35.6%) | | 15,778 (64.4%) | |

Table B-S3. Summary Statistics, by Type of Confinement

| | Any Administrative Segregation | | Any Punitive | | Any Temporary | | Any Protective | |
|---|---|---|---|---|---|---|---|---|
| | Mean / % | SD | Mean / % | SD | Mean / % | SD | Mean / % | SD |
| *Demographic Characteristics* | | | | | | | | |
| Non-White | 0.50 | 0.50 | 0.52 | 0.50 | 0.50 | 0.50 | 0.56 | 0.50 |
| Female | 0.08 | 0.27 | <0.01 | 0.02 | 0.04 | 0.20 | <0.01 | 0.00 |
| Age at Sentence | 30.03 | 9.98 | 29.20 | 9.71 | 30.37 | 9.89 | 28.74 | 9.19 |
| Single | 0.75 | 0.43 | 0.79 | 0.41 | 0.75 | 0.43 | 0.79 | 0.41 |
| Known Homosexual | 0.01 | 0.11 | 0.01 | 0.11 | 0.01 | 0.11 | 0.01 | 0.12 |
| *Human Capital* | | | | | | | | |
| Less than HS | 0.47 | 0.50 | 0.49 | 0.50 | 0.48 | 0.50 | 0.47 | 0.50 |
| GED | 0.23 | 0.42 | 0.24 | 0.43 | 0.24 | 0.43 | 0.22 | 0.41 |
| HS | 0.23 | 0.42 | 0.22 | 0.42 | 0.23 | 0.42 | 0.27 | 0.44 |
| More than HS | 0.06 | 0.23 | 0.05 | 0.21 | 0.05 | 0.23 | 0.04 | 0.20 |
| Pre-Sentence Employment | 0.21 | 0.24 | 0.19 | 0.23 | 0.21 | 0.24 | 0.18 | 0.21 |
| *Health and Substance Abuse* | | | | | | | | |
| History of Mental Illness | 0.25 | 0.43 | 0.24 | 0.42 | 0.23 | 0.42 | 0.21 | 0.41 |
| Underweight | 0.01 | 0.10 | 0.01 | 0.11 | 0.01 | 0.10 | 0.01 | 0.09 |
| Normal Weight | 0.44 | 0.50 | 0.43 | 0.49 | 0.43 | 0.49 | 0.42 | 0.49 |
| Overweight | 0.37 | 0.48 | 0.39 | 0.49 | 0.38 | 0.49 | 0.38 | 0.49 |
| Obese | 0.18 | 0.39 | 0.17 | 0.38 | 0.18 | 0.38 | 0.19 | 0.39 |
| History of Alcohol use | 0.61 | 0.49 | 0.59 | 0.49 | 0.63 | 0.48 | 0.54 | 0.50 |
| History of Marijuana Use | 0.62 | 0.49 | 0.63 | 0.48 | 0.64 | 0.48 | 0.60 | 0.49 |
| History of Stimulants Use | 0.36 | 0.48 | 0.35 | 0.48 | 0.38 | 0.49 | 0.30 | 0.46 |
| History of Opioids Use | 0.13 | 0.34 | 0.13 | 0.33 | 0.14 | 0.34 | 0.10 | 0.30 |
| History of Other Drug Use | 0.33 | 0.47 | 0.34 | 0.47 | 0.31 | 0.46 | 0.37 | 0.48 |
| Health Insurance at Sentencing | 0.18 | 0.38 | 0.17 | 0.38 | 0.17 | 0.38 | 0.16 | 0.37 |
| Physical Disability | 0.37 | 0.48 | 0.34 | 0.48 | 0.36 | 0.48 | 0.32 | 0.47 |
| *Criminal History* | | | | | | | | |
| 0-4 Prior Arrests | 0.24 | 0.43 | 0.25 | 0.43 | 0.24 | 0.43 | 0.26 | 0.44 |
| 5-9 Prior Arrests | 0.31 | 0.46 | 0.31 | 0.46 | 0.30 | 0.46 | 0.33 | 0.47 |
| 10+ Prior Arrests | 0.45 | 0.50 | 0.44 | 0.50 | 0.46 | 0.50 | 0.42 | 0.49 |
| Prior Felony Convictions | 2.36 | 3.28 | 2.35 | 3.33 | 2.51 | 3.47 | 2.22 | 2.84 |
| Prior Adult Jail Commitments | 2.77 | 4.06 | 2.46 | 3.57 | 2.78 | 3.98 | 2.26 | 3.27 |
| Prior Adult Prison Commitments | 1.30 | 1.96 | 1.34 | 1.86 | 1.37 | 1.99 | 1.31 | 1.81 |
| Prior Adult Probation Commitments | 1.60 | 1.88 | 1.45 | 1.77 | 1.57 | 1.80 | 1.38 | 1.75 |
| Prior Months in Prison | 34.05 | 52.59 | 36.99 | 55.19 | 35.11 | 53.41 | 36.99 | 54.82 |
| Prior In-Prison Violent Misconduct | 0.26 | 0.44 | 0.29 | 0.45 | 0.26 | 0.44 | 0.30 | 0.46 |
| Prior In-Prison Drug Misconduct | 0.18 | 0.38 | 0.19 | 0.39 | 0.19 | 0.39 | 0.20 | 0.40 |
| Prior In-Prison Contraband Misconduct | 0.23 | 0.42 | 0.25 | 0.43 | 0.22 | 0.42 | 0.26 | 0.44 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Prior In-Prison Disobeying Misconduct | 0.40 | 0.49 | 0.42 | 0.49 | 0.40 | 0.49 | 0.44 | 0.50 |
| *Statistical Risk Assessments* | | | | | | | | |
| Low Assault Risk | 0.29 | 0.45 | 0.22 | 0.41 | 0.27 | 0.45 | 0.18 | 0.38 |
| Middle Assault Risk | 0.63 | 0.48 | 0.68 | 0.47 | 0.64 | 0.48 | 0.72 | 0.45 |
| High Assault Risk | 0.08 | 0.28 | 0.10 | 0.30 | 0.08 | 0.28 | 0.10 | 0.29 |
| Low Property Risk | 0.33 | 0.47 | 0.32 | 0.47 | 0.32 | 0.47 | 0.32 | 0.47 |
| Middle Property Risk | 0.36 | 0.48 | 0.33 | 0.47 | 0.36 | 0.48 | 0.31 | 0.46 |
| High Property Risk | 0.31 | 0.46 | 0.35 | 0.48 | 0.32 | 0.47 | 0.37 | 0.48 |
| *Sentencing Factors* | | | | | | | | |
| Controlled Substance Crime | 0.08 | 0.27 | 0.06 | 0.24 | 0.08 | 0.27 | 0.06 | 0.24 |
| Violent Crime | 0.62 | 0.48 | 0.66 | 0.47 | 0.64 | 0.48 | 0.70 | 0.46 |
| Property Crime | 0.15 | 0.36 | 0.13 | 0.34 | 0.15 | 0.36 | 0.10 | 0.30 |
| Public Order Crime | 0.02 | 0.13 | 0.01 | 0.12 | 0.02 | 0.13 | 0.01 | 0.10 |
| Public Safety Crime | 0.13 | 0.33 | 0.13 | 0.33 | 0.11 | 0.32 | 0.12 | 0.33 |
| Total Offense Severity Score | 41.85 | 38.75 | 44.32 | 40.33 | 41.63 | 38.63 | 48.13 | 40.75 |
| Violent Offense in Sentence Cluster | 0.68 | 0.47 | 0.71 | 0.45 | 0.69 | 0.46 | 0.75 | 0.43 |
| Length of Prison Sentence | 72.12 | 92.60 | 81.43 | 103.30 | 71.28 | 92.98 | 94.95 | 110.74 |
| Observations | 5,017 | | 3,871 | | 6,237 | | 850 | |
| Proportion of Overall Sample | 20.5% | | 15.8% | | 25.4% | | 3.5% | |

Table B-S4. Selection Model, Probability of Solitary Confinement

| | coef. | odds ratio |
|---|---|---|
| *Demographic Characteristics* | | |
| Non-White | -0.037 | 0.964 |
| | (0.038) | (0.037) |
| Female | 0.437*** | 1.548*** |
| | (0.068) | (0.106) |
| Age at Sentence, 14-20 (ref: 26-30) | 0.987*** | 2.683*** |
| | (0.073) | (0.197) |
| Age at Sentence, 21-25 | 0.696*** | 2.006*** |
| | (0.059) | (0.119) |
| Age at Sentence, 31-35 | 0.314*** | 1.369*** |
| | (0.057) | (0.078) |
| Age at Sentence, 36-40 | -0.137** | 0.872** |
| | (0.058) | (0.051) |
| Age at Sentence, 41-45 | -0.296*** | 0.744*** |
| | (0.064) | (0.048) |
| Age at Sentence, 46-50 | -0.502*** | 0.605*** |
| | (0.076) | (0.046) |
| Age at Sentence, 51+ | -0.692*** | 0.501*** |
| | (0.086) | (0.043) |
| Known Homosexual | 0.485*** | 1.624*** |
| | (0.167) | (0.271) |
| Single | 0.013 | 1.013 |
| | (0.040) | (0.040) |
| *Human Capital* | | |
| GED (ref: <HS) | -0.018 | 0.983 |
| | (0.042) | (0.041) |
| High School | -0.086** | 0.918** |
| | (0.040) | (0.037) |
| > High School | -0.143** | 0.867** |
| | (0.067) | (0.058) |
| Pre-Prison Employment | -1.281*** | 0.278*** |
| | (0.186) | (0.052) |
| Pre-Prison Employment^2 | 0.326 | 1.385 |
| | (0.219) | (0.304) |
| *Health and Substance Use History* | | |
| Mental Illness History | 0.379*** | 1.461*** |
| | (0.041) | (0.059) |
| Underweight (ref: Normal Weight) | 0.324* | 1.382* |
| | (0.167) | (0.231) |
| Overweight | 0.052 | 1.053 |
| | (0.036) | (0.037) |
| Obese | 0.077* | 1.080* |
| | (0.045) | (0.048) |
| Any Use of Alcohol | -0.031 | 0.969 |
| | (0.040) | (0.039) |
| Any Use of Marijuana | -0.026 | 0.974 |
| | (0.039) | (0.038) |
| Any Use of Stimulants | 0.031 | 1.032 |
| | (0.039) | (0.041) |
| Any Use of Opioids | 0.065 | 1.067 |
| | (0.049) | (0.052) |
| Any Use of Other Drugs | 0.139*** | 1.150*** |
| | (0.040) | (0.046) |

| | | |
|---|---|---|
| Had Health Insurance at Pre-Sentencing | -0.089** | 0.915** |
| | (0.042) | (0.038) |
| Any Physical Disability | 0.036 | 1.037 |
| | (0.035) | (0.036) |
| *Criminal History* | | |
| Prior Felonies | 0.017* | 1.017* |
| | (0.009) | (0.009) |
| Prior Felonies^2 | -0.000 | 1.000 |
| | (0.000) | (0.000) |
| 5-9 Prior Arrests (ref: 0-4 Arrests) | 0.135*** | 1.145*** |
| | (0.045) | (0.051) |
| 10+ Prior Arrests | 0.264*** | 1.302*** |
| | (0.048) | (0.063) |
| Number of Adult Jail Commitments | 0.023*** | 1.023*** |
| | (0.005) | (0.005) |
| Number of Adult Prison Commitments | 0.026** | 1.026** |
| | (0.012) | (0.012) |
| Time in Prison Prior to Focal Sentence | -0.082*** | 0.921*** |
| | (0.018) | (0.016) |
| Ever Had Violent In-Prison Misconduct | 0.494*** | 1.639*** |
| | (0.054) | (0.089) |
| Ever Had Drug In-Prison Misconduct | -0.017 | 0.984 |
| | (0.053) | (0.052) |
| Ever Had Contraband In-Prison Misconduct | 0.247*** | 1.281*** |
| | (0.055) | (0.070) |
| Ever Had Disobedience In-Prison Misconduct | 0.419*** | 1.520*** |
| | (0.063) | (0.096) |
| Sentenced to Person Crime (ref: Controlled Substance) | 0.529*** | 1.697*** |
| | (0.056) | (0.095) |
| Sentenced to Property Crime | 0.546*** | 1.726*** |
| | (0.060) | (0.104) |
| Sentenced to Public Order Crime | 0.398*** | 1.489*** |
| | (0.119) | (0.177) |
| Sentenced to Public Safety Crime | 0.384*** | 1.469*** |
| | (0.067) | (0.098) |
| SGL Total Offense Severity Score | 0.001 | 1.001 |
| | (0.001) | (0.001) |
| SGL Total Offense Severity Score^2 | 0.000 | 1.000 |
| | (0.000) | (0.000) |
| *Risk Scores* | | |
| Middle Assault Risk (ref: Low Risk) | 0.127*** | 1.136*** |
| | (0.043) | (0.048) |
| High Assault Risk | 0.664*** | 1.942*** |
| | (0.088) | (0.172) |
| Middle Property Risk (ref: Low Risk) | 0.164*** | 1.179*** |
| | (0.042) | (0.049) |
| High Property Risk | 0.370*** | 1.448*** |
| | (0.053) | (0.077) |
| *Prison Length* | | |
| Logged Prison Sentence (Months) | 0.664*** | 1.943*** |
| | (0.025) | (0.049) |
| Constant | -4.205*** | 0.015*** |
| | (0.136) | (0.002) |
| Observations | 22,479 | 22,479 |

Table B-S5. Results from Alternative Estimation Strategies

| | IPTW | | Doubly Robust | | Propensity Score Matching | |
|---|---|---|---|---|---|---|
| | b | se | b | se | b | se |
| *A. Ever Convicted of a Felony* | | | | | | |
| Within 1 year | 0.068*** | (0.006) | 0.066*** | (0.005) | 0.072*** | (0.007) |
| Within 3 years | 0.182*** | (0.009) | 0.169*** | (0.009) | 0.192*** | (0.011) |
| Within 5 years | 0.220*** | (0.010) | 0.215*** | (0.011) | 0.236*** | (0.014) |
| *B. Ever Convicted of a Violent Felony* | | | | | | |
| Within 1 year | 0.030*** | (0.003) | 0.026*** | (0.003) | 0.029*** | (0.004) |
| Within 3 years | 0.098*** | (0.006) | 0.086*** | (0.006) | 0.102*** | (0.007) |
| Within 5 years | 0.134*** | (0.008) | 0.119*** | (0.007) | 0.130*** | (0.010) |
| *C. Ever Imprisoned for Any Reason* | | | | | | |
| Within 1 year | 0.101*** | (0.007) | 0.097*** | (0.007) | 0.102*** | (0.008) |
| Within 3 years | 0.216*** | (0.009) | 0.202*** | (0.009) | 0.223*** | (0.012) |
| Within 5 years | 0.260*** | (0.010) | 0.247*** | (0.010) | 0.271*** | (0.013) |
| *D. Ever Imprisoned for a Technical Violation* | | | | | | |
| Within 1 year | 0.059*** | (0.006) | 0.056*** | (0.006) | 0.060*** | (0.007) |
| Within 3 years | 0.094*** | (0.008) | 0.092*** | (0.008) | 0.100*** | (0.010) |
| Within 5 years | 0.108*** | (0.010) | 0.106*** | (0.009) | 0.117*** | (0.012) |
| *E. Ever Imprisoned for a New Sentence* | | | | | | |
| Within 1 year | 0.044*** | (0.004) | 0.042*** | (0.004) | 0.043*** | (0.005) |
| Within 3 years | 0.150*** | (0.007) | 0.134*** | (0.007) | 0.146*** | (0.009) |
| Within 5 years | 0.222*** | (0.009) | 0.203*** | (0.009) | 0.222*** | (0.012) |

Note: IPTW = inverse probability of treatment weighting, b = treatment effect, se = standard error.
*** p<0.001, ** p<0.01, * p<0.05

Table B-S6. Covariate Balance, Comparison of Standardized Differences in Raw and Weighted Means and Variances Between Treated and Untreated Cases

| | Mean | | Variance | |
|---|---|---|---|---|
| | Raw | Weighted | Raw | Weighted |
| Non-White | -0.01 | 0.01 | 1.00 | 1.00 |
| Female | 0.06 | -0.02 | 1.21 | 0.95 |
| 14-20 (ref: 31-35) | 0.23 | 0.00 | 1.85 | 0.99 |
| 21-25 | 0.14 | 0.01 | 1.26 | 1.02 |
| 26-30 | 0.02 | 0.00 | 1.05 | 1.00 |
| 36-40 | -0.05 | 0.00 | 0.90 | 0.99 |
| 41-45 | -0.07 | 0.00 | 0.84 | 1.01 |
| 46-50 | -0.12 | 0.00 | 0.67 | 0.99 |
| 51+ | -0.18 | 0.00 | 0.48 | 0.99 |
| Known Homosexual | 0.04 | 0.01 | 1.50 | 1.08 |
| Single | 0.22 | 0.01 | 0.86 | 0.99 |
| GED | 0.11 | 0.00 | 1.14 | 1.00 |
| HS | -0.15 | 0.00 | 0.86 | 1.00 |
| >HS | -0.09 | 0.00 | 0.73 | 0.99 |
| Pre-Sentence Employment | -0.35 | -0.01 | 0.69 | 1.01 |
| Mental Illness History | 0.17 | -0.01 | 1.28 | 0.98 |
| Underweight | 0.02 | 0.00 | 1.22 | 0.98 |
| Overweight | -0.03 | 0.00 | 0.99 | 1.00 |
| Obese | -0.03 | -0.01 | 0.95 | 0.98 |
| Ever Used Alcohol | 0.00 | 0.01 | 1.00 | 0.99 |
| Ever Used Marijuana | 0.09 | 0.00 | 0.94 | 1.00 |
| Ever Used Stimulants | 0.06 | 0.00 | 1.01 | 1.00 |
| Ever Used Opioids | 0.09 | 0.00 | 1.17 | 1.00 |
| Ever Used Other Drugs | 0.03 | -0.01 | 1.04 | 0.99 |
| Baseline Health Insurance | -0.05 | -0.02 | 0.92 | 0.97 |
| Physical Disability | -0.03 | 0.00 | 0.99 | 1.00 |
| Number of Prior Felony Convictions | 0.07 | 0.00 | 1.24 | 1.00 |
| 5-9 Prior Arrests | -0.01 | -0.01 | 0.99 | 0.99 |
| 10+ Prior Arrests | 0.08 | 0.01 | 1.00 | 1.00 |
| Prior Adult Jail Commitments | 0.06 | 0.00 | 1.15 | 0.88 |
| Prior Prison Commitments | 0.11 | 0.01 | 1.46 | 1.11 |
| Prior Time in Prison (Logged Months) | 0.16 | 0.01 | 1.07 | 0.98 |
| Ever Had Violent Misconduct | 0.29 | 0.01 | 1.61 | 1.01 |
| Ever Had Drug Misconduct | 0.11 | 0.01 | 1.20 | 1.02 |
| Ever Had Contraband Misconduct | 0.22 | 0.01 | 1.50 | 1.01 |
| Ever Had Disobedience Misconduct | 0.25 | 0.02 | 1.16 | 1.01 |
| Person Crime (ref: Drug Crime) | 0.10 | -0.02 | 1.03 | 1.00 |
| Property Crime | 0.13 | 0.00 | 1.17 | 1.00 |
| Public Order Crime | -0.04 | 0.00 | 0.77 | 1.02 |
| Public Safety Crime | -0.09 | 0.03 | 0.83 | 1.08 |
| SGL Offense Severity Score | 0.00 | 0.00 | 0.93 | 0.97 |
| Middle Assault Risk (ref: Low Risk) | 0.21 | 0.00 | 1.02 | 1.00 |
| High Assault Risk | 0.15 | 0.01 | 2.19 | 1.06 |
| Middle Property Damage Risk (ref: Low Risk) | -0.01 | -0.01 | 1.00 | 1.00 |
| High Property Damage Risk | 0.32 | 0.02 | 1.53 | 1.01 |

Table B-S7. Probability of Being in Prison Beyond First Eligible Parole (Minimum Prison Sentence)

| | coef. | odds ratio |
|---|---|---|
| *Treatment Variables* | | |
| Ever in Solitary | 0.164*** | 1.178*** |
| | (0.036) | (0.042) |
| Cumulative Months in Solitary | 0.001 | 1.001 |
| | (0.004) | (0.004) |
| Number of Solitary Entries | 0.020*** | 1.020*** |
| | (0.005) | (0.005) |
| *Demographics* | | |
| Non-White | 0.014 | 1.014 |
| | (0.035) | (0.035) |
| Female | -0.187*** | 0.829*** |
| | (0.063) | (0.052) |
| Age at Sentence, 14-20 (ref: 31-35) | 0.012 | 1.012 |
| | (0.068) | (0.069) |
| Age at Sentence, 21-25 | 0.101* | 1.106* |
| | (0.054) | (0.060) |
| Age at Sentence, 26-30 | 0.046 | 1.047 |
| | (0.052) | (0.054) |
| Age at Sentence, 36-40 | -0.018 | 0.982 |
| | (0.052) | (0.051) |
| Age at Sentence, 41-45 | 0.051 | 1.053 |
| | (0.056) | (0.059) |
| Age at Sentence, 46-50 | 0.044 | 1.045 |
| | (0.065) | (0.068) |
| Age at Sentence, 51+ | 0.055 | 1.056 |
| | (0.071) | (0.076) |
| Known Homosexual | 0.345** | 1.412** |
| | (0.167) | (0.236) |
| Single | 0.012 | 1.013 |
| | (0.035) | (0.036) |
| *Human Capital* | | |
| GED (ref: < High School) | -0.022 | 0.978 |
| | (0.039) | (0.038) |
| High School | 0.052 | 1.053 |
| | (0.035) | (0.037) |
| > High School | -0.035 | 0.966 |
| | (0.058) | (0.056) |
| Pre-Sentence Employment | -0.651*** | 0.521*** |
| | (0.164) | (0.086) |
| Pre-Sentence Employment^2 | 0.615*** | 1.850*** |
| | (0.185) | (0.342) |
| *Health and Substance Use History* | | |
| Mental Illness History | 0.157*** | 1.170*** |
| | (0.038) | (0.044) |
| Underweight | 0.146 | 1.157 |
| | (0.162) | (0.188) |
| Overweight | -0.039 | 0.962 |
| | (0.032) | (0.031) |
| Obese | -0.027 | 0.974 |
| | (0.040) | (0.039) |
| Ever Used Alcohol | -0.006 | 0.994 |

| | | |
|---|---|---|
| | (0.037) | (0.037) |
| Ever Used Marijuana | -0.025 | 0.976 |
| | (0.035) | (0.034) |
| Ever Used Stimulants | -0.039 | 0.962 |
| | (0.036) | (0.034) |
| Ever Used Opioids | -0.093** | 0.911** |
| | (0.044) | (0.041) |
| Ever Used Other Drugs | -0.018 | 0.982 |
| | (0.037) | (0.036) |
| Baseline Health Insurance | 0.014 | 1.014 |
| | (0.037) | (0.038) |
| Physical Disability | -0.020 | 0.980 |
| | (0.031) | (0.031) |
| *Criminal History* | | |
| Number of Prior Felony Convictions | -0.026*** | 0.974*** |
| | (0.010) | (0.009) |
| Number of Prior Felony Convictions^2 | 0.001 | 1.001 |
| | (0.000) | (0.000) |
| 5-9 Prior Arrests | -0.133*** | 0.876*** |
| | (0.040) | (0.035) |
| 10+ Prior Arrests | -0.204*** | 0.816*** |
| | (0.043) | (0.035) |
| Prior Adult Jail Commitments | -0.008* | 0.992* |
| | (0.004) | (0.004) |
| Prior Prison Commitments | 0.048*** | 1.049*** |
| | (0.014) | (0.014) |
| Prior Time in Prison (Logged Months) | 0.158*** | 1.171*** |
| | (0.016) | (0.018) |
| Ever Had Violent Misconduct | 0.052 | 1.054 |
| | (0.052) | (0.055) |
| Ever Had Drug Misconduct | -0.029 | 0.971 |
| | (0.049) | (0.048) |
| Ever Had Contraband Misconduct | 0.057 | 1.059 |
| | (0.053) | (0.056) |
| Ever Had Disobedience Misconduct | -0.004 | 0.996 |
| | (0.055) | (0.055) |
| *Focal Sentencing Variables* | | |
| Person Crime (ref: Drug Crime) | 0.719*** | 2.052*** |
| | (0.049) | (0.100) |
| Property Crime | 0.310*** | 1.363*** |
| | (0.051) | (0.070) |
| Public Order Crime | 0.769*** | 2.157*** |
| | (0.098) | (0.212) |
| Public Safety Crime | 0.366*** | 1.442*** |
| | (0.055) | (0.080) |
| SGL Offense Severity Score | 0.006*** | 1.006*** |
| | (0.001) | (0.001) |
| SGL Offense Severity Score^2 | -0.000*** | 1.000*** |
| | (0.000) | (0.000) |
| *Risk Assessments* | | |
| Middle Assault Risk (ref: Low Risk) | 0.487*** | 1.627*** |
| | (0.038) | (0.062) |
| High Assault Risk | 0.724*** | 2.063*** |
| | (0.089) | (0.184) |
| Middle Property Damage Risk (ref: Low Risk) | -0.246*** | 0.782*** |
| | (0.037) | (0.029) |

| | | |
|---|---|---|
| High Property Damage Risk | -0.325*** | 0.723*** |
| | (0.051) | (0.037) |
| Sentenced in 2004 (ref: 2003) | -0.004 | 0.996 |
| | (0.038) | (0.038) |
| Sentenced in 2005 | -0.061 | 0.941 |
| | (0.040) | (0.037) |
| Sentenced in 2006 | -0.151*** | 0.860*** |
| | (0.040) | (0.035) |
| Constant | -0.570*** | 0.565*** |
| | (0.100) | (0.056) |
| Observations | 22,479 | 22,479 |

*** p<0.001, ** p<0.01, * p<0.05

# CHAPTER 3

## SOLITARY CONFINEMENT AND MORTALITY

### Introduction

Mass incarceration disproportionately draws from disadvantaged and vulnerable populations that have high burdens of infectious and chronic illnesses (Binswanger, Krueger, and Steiner 2009; Massoglia 2008; National Research Council 2014; Schnittker, Massoglia, Uggen, et al. 2011). Such populations also suffer from high rates of mental illness and substance abuse, conditions which may be under-diagnosed and which may not receive adequate treatment while in custody (Abramsky and Fellner 2003; Brinkley-Rubinstein 2013; Fellner 2006). Recent research suggests that the experience of prison itself may exacerbate the health and well-being of this already vulnerable population. That is, imprisonment is a source of acute and chronic stress and is associated with obstacles to social integration (Massoglia and Pridemore 2015). Exposure to imprisonment has been linked to both short- and long-term risks of health and mortality consequences, including heightened risk of fatal overdoses, suicides, as well as a host of chronic and stress-related illnesses (Binswanger et al. 2007; Massoglia 2008; Pratt et al. 2006; Schnittker and John 2007).

Despite this growing area of research, whether and how confinement conditions – the nature of exposure to imprisonment – impact long-term health and mortality is unclear. Solitary confinement represents one of the most consequential experiences of imprisonment because conditions of confinement are extraordinarily harsh. Growing consensus indicates that solitary

confinement, especially long-term stays, can result in lasting and devastating psychological damage, including anger, aggression, anxiety, depression, hypersensitivity to external stimuli, and even psychosis (Arrigo and Bullock 2007; Grassian 1983; Haney 2003a, 2012; Rhodes 2004; Smith 2006). What remains less understood are the impacts of solitary confinement after release from prison. Because the majority of prisoners are eventually released back into the community (nearly 700,000 annually) (Travis 2005), what happens to prisoners in the days, months, and years after release requires more investigation. While evidence suggests that exposure to prison environments is detrimental to one's health and mortality (Massoglia and Pridemore 2015), whether the experience of solitary confinement intensifies the health consequences of imprisonment requires more investigation.

Solitary confinement presents a case to examine the relationship between social isolation and individual well-being. A growing body of research has linked social connectedness to individual well-being. Much of this research has focused on social isolation among older adults, an especially vulnerable population because of higher morbidity and mortality (e.g., Cornwell and Waite 2009; Steptoe et al. 2013). Prisoners represent another large and vulnerable population because of the health consequences of imprisonment and because they are separated by distance and time from their networks of support. Prisoners in solitary confinement are an extreme case of (forced) social isolation because of restrictions on their social interactions with other prisoners and contact with family, friends, and other sources of social support on the outside. Studying this group offers an opportunity to explore one avenue – social support (or the lack thereof) – through which social isolation impacts well-being.

Despite widespread use of solitary confinement, its long-term consequences are not well known (Frost and Monteiro 2016; Mears 2016). While studies have identified heightened risks of

self-harm and suicide while in solitary units (Cloud et al. 2015; Kaba et al. 2014; Lanes 2009), how exposure to solitary confinement impacts the well-being of individuals long after release from prison is not well-understood. This study fills in knowledge gaps by investigating the relationship between exposure to solitary confinement and specific causes of mortality, both while inmates are held in custody and long after release from prison. In doing so, this study attends to heterogeneity in the experience of imprisonment and its attendant effects on mortality.

## Theoretical Framework

Research on the collateral consequences of imprisonment increasingly focuses on the spillover effects of imprisonment on health and mortality (Massoglia and Pridemore 2015). On the one hand, prior work suggests several processes through which imprisonment negatively impact health and mortality. Prisons (1) expose inmates to communicable diseases, poor living conditions, and potential interpersonal violence; (2) provide inadequate detection and treatment of illnesses; (3) elevate stress due to the nature of prison life; (4) reduce tolerance to and knowledge of dosage of controlled substances (as prison removes individuals from current drug markets); and (5) initiate a chain of stressors related to the difficulties of reintegration, including securing basic material needs, finding employment, and maintaining relationships with family, friends, and romantic partners (Binswanger et al. 2007, 2013; Massoglia et al. 2014; Massoglia and Pridemore 2015; Turney, Wildeman, and Schnittker 2012). On the other hand, prior work also suggests a number of ways through which imprisonment positively affects health and mortality. Prisons (1) remove individuals from unsafe and unhealthy environments (minority and poor men in particular); (2) provide basic meals and nutrition; and (3) monitor and ensure compliance to medical and drug treatments (Massoglia and Pridemore 2015; Patterson 2010). While this line of research has yet to yield conclusive evidence, two recent reviews suggests that

there is mounting that the experience of imprisonment is an acute and chronic stressor and that imprisonment is an obstacle to social integration (Massoglia and Pridemore 2015; National Research Council 2014). There is also growing evidence that confinement conditions, such as overcrowding, may generate variation in the impacts of imprisonment (Dye 2010; Huey and McNulty 2005; Rabe 2012). Below, I build on this research and discuss the potential pathways through which experiences in solitary confinement influence the risk of mortality.

*Social Isolation*

While the post-release mortality consequences of solitary confinement are understudied, a growing body of research has linked social connectedness to individual well-being, finding that socially isolated individuals suffer higher rates of cardiovascular disease, cancer, infectious disease, cognitive decline, psychological distress, and mortality (Cornwell and Waite 2009; Eng et al. 2002; Holt-Lunstad et al. 2010; House 2001; Seeman 1996; Steptoe et al. 2013; Uchino 2006). This line of research suggests several potential pathways that link social connectedness and health. Social isolation is associated certain biological processes, including elevated blood pressure and heightened inflammatory and metabolic responses to stress (Steptoe et al. 2013). On the flip side, social support is related to improved cardiovascular, neuroendocrine, and immune system functioning (Uchino 2006). There are also psychological mechanisms. Social isolation diminishes self-efficacy, or the ability to carry specific behaviors, which is linked to positive health (Berkman et al. 2000); moreover, social connectedness provides purpose by establishing meaningful social roles (Holt-Lunstad et al. 2010). Finally, social relationships provide resources to adapt to and buffer against acute and chronic stressors on health, such as life events or transitions (Holt-Lunstad et al. 2010).

Prior research offers evidence that imprisonment is an acute and chronic source of stress (Massoglia and Pridemore 2015). Isolation in solitary may exacerbate the stress of imprisonment. Solitary confinement restricts access to potential sources of social support, which are important to buffer against the pains and stresses of imprisonment. Indeed, individuals who have experienced isolation report that contacts with family and relatives are critical to weathering the stresses and pains of life in solitary (Casella, Ridgeway, and Shourd 2016). While prisoners in general are separated from networks of support, those placed in solitary experience this more acutely because of restrictions placed on contact with the outside world (Huey and McNulty 2005). Contact visits, telephone calls, and correspondences are severely limited, if not denied altogether. Segregating inmates in single cells for up to 24 hours a day also removes them from informal networks of support among other inmates (Clemmer 1958). The absence of or limited social support, given the stresses of life in prison generally and in solitary especially, potentially impact mental and physical well-being.

Research demonstrates that individuals in solitary confinement are at high-risk of suicide, but also nonfatal self-harm, including self-mutilation (cutting) and self-destructive behavior (swallowing sharp objects) (Kaba et al. 2014; Lanes 2009). Studies also consistently find that solitary confinement produces a range of lasting mental health damage, including impaired sense of identity, hypersensitivity to stimuli, cognitive dysfunction, anxiety and depression, anger, aggression and overall deterioration of mental health (Hagan et al. 2017; Haney 2003b; Rhodes 2004). Some termed the collection of these effects as post-security housing unit (post-SHU) syndrome as well as post-traumatic syndrome disorder (PTSD) (Hagan et al. 2017; Kupers 2017). Time in solitary can aggravate existing mental illness or even trigger the development of

new ones. Ultimately, this research suggests increased risk of suicides as well as stress-related morbidity and mortality after release.

*Material Deprivation*

The physical conditions of solitary units can contribute to poorer physical health. First, physical activity is severely limited as inmates are restricted to their units. Inmates are usually allotted only a few hours per week for exercise, and this privilege is not always guaranteed. Research has shown that physical exercise is an important preventative measures against a number of conditions, including hypertension, arthritis, and heart disease particularly for older adults (Williams 2016). Second, conditions of solitary units are often unsanitary and poorly ventilated, and thereby elevate risk of chronic diseases (such as asthma). Third, solitary units often lack natural sunlight, and as a result, inmates may suffer from vitamin D deficiency (Casella et al. 2016). Vitamin D deficiency has been linked to increased incidence of schizophrenia and depression, is associated with poor bone health, and is an independent predictor of cancer and other chronic diseases, such as cardiovascular diseases (Holick 2007). Fourth, inmates in solitary may have poor or inadequate nutrition. Food and water restrictions (such as "food loaf") may be imposed as an additional punishment for infractions or misbehavior in solitary units. Individuals may also be limited or restricted from purchasing foods from prison commissionaires to supplement their diet.

*Prisonization and Self-Efficacy*

The intense stresses of life in isolation induces maladaptive coping strategies that encourages destructive behavior. Individuals have few avenues to air wants or grievances and have little control over their lives. Individuals in solitary units are prone to act out in destructive

ways, including violent outbursts and assaults against staff (Haney and Lynch 1997; Irwin 2005; Toch and Adams 2002). In the long-run, experiences in solitary confinement has been associated with increased irritability, anger, aggression, impulsiveness, and rage, which increases the propensity for interpersonal conflict and violence after release (Grassian 2006; Haney 2003b, 2012; Lerman 2013; Rhodes 2004). Moreover, the extent of control and surveillance in solitary units erodes individuals' ability to self-regulate, and this loss of control diminishes self-efficacy (Shalev 2008). Hopelessness and fatalism, in turn, elevates the risk of destructive behavior, including self-harm (Kaba et al. 2014) and suicide (Haney 2003b; Kupers 1999). Individuals may also become accustomed to intense regulation of their time and behavior, and over time, experience diminished impulse-control and lose the capacity to self-regulate, which complicates adjustment to the lack of structure on the outside and increases the likelihood of risky behavior (Arrigo and Bullock 2007; Haney 2003b; Irwin 2005).

*Transition to Society*

In the face of such extreme conditions, individuals may have little choice but to develop counterproductive and maladaptive coping strategies (Haney 2017) that may exacerbate the challenges of reentry and increase the risk of mortality. Social withdrawal and a general suspicion of other people impede an ability to re-establish social bonds with family and social networks, which are critical to meeting even very basic material needs after release from prison (Harding et al. 2013). Adjusting to life outside, with its myriad of choices and decisions to be made, can be especially difficult for individuals who are accustomed to the highly structured nature of life in solitary units. Compounded stress, furthermore, can lead to negative coping strategies, such as substance use, as well as engagement in high-risk behaviors related to

accidental deaths. Finally, individuals who renounce their gang affiliation while in custody (or solitary) may face retaliation upon release – thereby, facing increased risks of violence and homicide (Mears 2016).

*Summary of Expectations*

Based on prior research, it is possible to generate a number of expectations regarding the relationship between exposure to solitary confinement and mortality. Research also suggests that this relationship may depend on the nature of exposure. In this study, I focus on three dimensions: current status in solitary, cumulative length of exposure, and frequency of spells in solitary. Each offers different insights into the potential pathways that operate in the relationship between solitary confinement and mortality. First, research on the protective impacts of imprisonment suggests being currently in solitary is expected to significantly reduce the risks of accidental and injury-related deaths (such as overdose, homicides, and transportation) relative to being in the community (the comparison is between those in prison and those on the outside) (Patterson 2010; Schnittker, Massoglia, Uggen, et al. 2011). However, time in solitary confinement may increase the risk of suicides and other acts of self-harm and accidents relative to being in the general prison population (the comparison is among those who are incarcerated) (Kaba et al. 2014; Kupers 1999; Lanes 2009). Second, with regard to the duration of exposure, many mechanisms reviewed above suggests worse mortality outcomes with longer stays among those who are incarcerated. Prolonged stays increase stress and lead to the erosion of mental as well as physical health. In addition, longer stays could lead to the entrenchment of maladaptive behaviors associated with violent and risky behaviors. Finally, more frequent trips to solitary may elevate stress related to transitions from solitary to the general prison population as well as

solitary to the society world. The constant churning in and out of isolation units could disrupt connections with sources of social support.

## Data and Methods

This study draws on administrative data from the Michigan Department of Corrections (MDOC) on all individuals convicted of a new felony and sentenced between January 1, 2003 to December 31, 2006 (N=140,267), and followed through December 31, 2012. The final cohort (N=46,513 individuals; N=4,819,124 person-month observations) consists of all individuals who were sentenced to prison during the four-year baseline period or at any point during follow up. Follow up for individuals was censored at the time of death for any cause or at the end of the observation period on December 31, 2012, whichever occurred first.

### *Exposure*

Exposure to solitary confinement is defined as placement in segregation units for any reason (administrative, punitive, temporary, and protective) for at least one day (N=15,965) at any point during the observation period. The study focuses on three focal time-varying exposure measures: current status (in solitary, in the general prison population, and in the community), cumulative days in solitary (0, 1-15, 16 or more days), and number of admissions to solitary.[10] Movements in the correctional system were drawn from MDOC administrative databases, including type of cell assignment (general prison population, administrative segregation, punitive

[10] Results are consistent using smaller categories (0, 1-7, 8-30, 31-180, and 181 or more days). The preferred cut-off was chosen to ensure sufficient cases in each category. Moreover, evidence suggests solitary confinement is associated with lasting damage after 15 days (Méndez 2011).

segregation, temporary segregation, and protective segregation), dates of movements, and subsequent prison admissions.

*Mortality Outcomes*

Administrative data from MDOC were linked to the National Death Index (NDI), a national database of deaths extracted from state death certificates, to obtain mortality data. Matches to NDI were based on first name, middle initial, and last name, social security number, state and date of birth, race, sex, and any known aliases. The NDI provided the date of death and the state of death. The analysis focuses on all-cause as well as cause-specific mortality to assess potential explanations between the solitary confinement and mortality. Causes of death were classified based on the International Classification of Disease (ICD) – 10 codes, indicating the underlying cause of death. Deaths were grouped into two broad categories. Injury-related deaths consist of overdose, transportation accidents, other accidents, suicide, homicide, and other external causes. Illness-related deaths include cancer, cardiovascular disease, respiratory disease, liver or kidney disease, other non-infectious diseases, HIV, and other infectious diseases. Deaths are identified from the beginning of the study period on January 1, 2003 through December 31, 2012.

*Covariates*

Information on baseline factors and prison cell movements were draw from Pre-Sentence Information (PSI) reports and MDOC's databases. Self-reported health measures include history of mental illness, physical disability, health insurance, body mass index (BMI) calculated from height and weight (underweight, normal, overweight, and obese), and substance use history (alcohol, marijuana, stimulants, opioids, and other drugs). Demographic characteristics include

race (non-white, white), age at sentencing (14-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51+), gender, marital status (single, non-single), known homosexual, and educational attainment (less than high school, GED equivalent, high school, and more than high school). The PSI reports also provided data on criminal history, including prior felony convictions and the number of prior adult jail, prison, and probation commitments. Prior number of arrests (0-4, 5-9, and 10 or more) were drawn the Michigan State Police. Statistical risk assessments of assaultive risk and property damage were extracted from the MDOC databases. Assaultive risk (low, middle, and high) is scored based on the type of crime individuals are sentenced (i.e., robbery, sexual assault, murder, or any assaultive felony), first arrest before the age of 15, prior serious institutional misconduct in prison, reported history of juvenile felony, and whether individuals were ever married. Property risk (low, middle, and high) is based on reported history of juvenile history, prior serious institutional misconduct in prison, first arrest before the age of 15, and history of drug abuse. Information on the focal sentence (the original sentence that entered individuals into the study between 2003 and 2006) include the type of sentence (jail, jail and probation, prison, and probation), the type of crime (controlled substance, violent, property, public order, and public safety) and total offense severity score based on the sentencing guidelines. Summary statistics for these baseline characteristics are reported in Supplemental Table C-S1.

In the statistical analysis, I first calculated crude mortality rates (CMR) as the number of deaths per 100,000 person-years of follow-up with 95% confidence intervals (CI). I calculated all-cause and cause-specific rates for each setting, time in prison and time in the community. Cox proportional hazards regression models were used to examine the association between exposure to solitary confinement and mortality. All models adjust for identified in Supplemental Table S-

1, in addition to sentencing year and county fixed effects. Competing risk regression models were used to examine cause-specific mortality (Fine and Gray 1999).

## Results

Table C-1 reports summary statistics of exposures across all person-months. Exposure to solitary confinement represents 20% of all observations for the full sample. For the full sample the majority of observations are time in the community (55%) or time in the general prison population (42%). Among observations with exposure, a greater proportion are for time in the general prison population (57%) and time in solitary (13%), and smaller share for time in the community (29%). With regard to cumulative time in solitary, spending 1-15 days total represents about 9% of observations, while spending 16 or more days accounts for about 12% of observations. Among observations with exposure, 1-15 days make up 42% of observations and 16 or days represents 58%. Finally, the average number of trips to solitary was 1 for the full sample and nearly 5 for those with exposure.

*[Table C-1 about here]*

Table C-2 reports crude death rates (per 100,000 person-years) for all-cause and cause-specific mortality for the overall sample and separately by exposure to solitary confinement. It is important to note that all results pertain to a sample of individuals convicted of a felony conviction. For the overall sample, which includes deaths that occurred during and after imprisonment, the crude rate for all-cause mortality is 485.7 (95% CI 463.9, 508.6) deaths per 100,00. The rate for injury-related mortality is 223.2 (95% CI 208.6, 238.9), with overdose, homicide, and suicide as the three leading causes. The rate for illness-related mortality is slightly higher at 262.5 (95% CI 246.6, 279.5), with cardiovascular disease, cancer, and other non-

infectious diseases as leading causes. The all-cause mortality rate is slightly higher for individuals with exposure to solitary compared to those with no exposure, at 506.7 (95% CI 456.5, 562.4) compared to 480.9 (95% CI 456.9, 506.2). The rate for injury-related mortality is larger for the those with exposure, while the rate for illness-related mortality is higher for those without exposure.

*[Table C-2 about here]*

Overall rates reflect both time in prison and time in the community, and each carries different risk profiles. Table C-3 reports crude death rates only for time in prison. As expected, rates for substantially lower than the overall rates reported in Table C-2 for the overall sample and by exposure to solitary confinement. Notably, even while in prison, the injury-related death rate is higher for individuals with exposure [51.2 (95% CI 34.3, 76.4)] compared to those with no exposure [24.3 (95% CI 16.8, 35.3)]; this difference largely reflects a much higher rate of suicide for those with exposure.

*[Table C-3 about here]*

Table C-4 reports rates for time in the community. Rates across all groups are substantially larger than those for time in prison, indicating greater risks upon release from prison. The all-cause death rate for those with any exposure to solitary confinement is dramatically higher [1,161.2 (95% CI 1029.5, 1309.8)] than those with no exposure [675.3 95% CI (639.3, 713.4)]. Again, the discrepancy in rates represent greater risk of injury-related deaths in the community for individuals with any exposure [731.8 (95% CI 628.8, 851.6) compared to 325.3 (95% CI 300.6, 352.0)]. For this group, the leading causes of death that are significantly higher than individuals with no exposure to solitary confinement are homicide, overdose, suicide, and transportation accidents. While rates for illness-related deaths for generally higher as

well for those with any exposure, only the rate for HIV deaths is significantly higher. These leading causes together suggest greater risks of risky behaviors.

*[Table C-4 about here]*

Differences in crude death rates could stem from compositional differences between the two group. Table 5 reports results from Cox proportional hazards and competing risk models, which adjusts for potential confounders, for all-cause, injury-related, and illness-related mortality. The three measures of interest are current status, total days, and number of spells in solitary confinement. Models control for an extensive set of time-invariant factors (all shown in Table C-1) as well as a time-varying measure of total time spent in prison. Results show that being held in prison is protective against all-cause mortality. Relative to being in the community, being in the general prison population is significantly associated with an 80% reduction in the odds and being in solitary is associated with a 61% reduction (this is not statistically different from the reduction in the general prison population, however). This finding is consistent with prior work that suggests imprisonment is protective relative to high-risk environments the incarcerated population faces in the community, particularly minority and poor individuals (Patterson 2010; Schnittker, Massoglia, and Uggen 2011). Net of current status, any number of days in solitary confinement is significantly associated with greater risk of all-cause mortality. Individuals who spent 1-15 or 16 or more total days in solitary have about 1.5 times the odds of death compared to those who did not experience solitary. The number of spells in solitary, while positive, is not significantly associated with all-cause mortality. On the whole, results suggest that among prisoners the additional experience of solitary confinement (of any length) is associated with elevated risk of all-cause mortality.

*[Table C-5 about here]*

Unconditional mortality rates suggest potential variation in effects by injury- and illness-related causes. Results support this expectation. Current status in the general prison population relative to being in the community is associated with greater reductions in the odds of injury-related deaths (94% reduction) than illness-related deaths (64% reduction). Being in solitary, however, is less protective, where the odds of injury-related deaths are reduced by 79% and illness-related deaths by 30% (though not statistically significant). Together, this suggests that the protective effect of imprisonment (relative to being outside in the community) diminishes while individuals are held in solitary (in fact, it is no longer significant for illness-related deaths). Elevated risk of mortality from time spent in solitary primarily reflects significant increases in injury-related rather than illness-related deaths. Spending 1-15 total days in solitary elevates the odds of injury-related deaths by 75% and16 or more days by 84%. While not significant, spending 1-15 days increases the risk of illness-related deaths by 25%, 16 or more days by 23%. There is not associated significant impact of the frequency of trips to solitary. These findings suggest that solitary confinement is associated with increased propensity for risky behaviors after release from prison.

To further explore potential proximate mechanisms, I examine the relationship between solitary confinement and specific causes of deaths. Recall that injury-related deaths consist of overdose, transportation accidents, other accidents, suicide, homicide, and other external causes, and illness-related deaths include cancer, cardiovascular disease, respiratory disease, liver or kidney disease, other non-infectious diseases, HIV, and other infectious diseases. Table C-6 reports from competing risk models of injury-related causes of death. Results show that spending any amount of time in solitary is significantly associated with increased odds of homicide, suicide, transportation accidents, and to a lesser extent, overdose and other accidents.

Furthermore, having more spells in solitary is associated with increased risk of other accidents. As expected, results indicate strong protective effects of being in custody, both in the general population and in solitary. There are, however, two notable exceptions. Being held in solitary is not associated with a significant reduction in suicides, relative to being in the community. It is also associated with increased risks of other accidents (though not significant). These findings are consistent with prior research documenting high rates of destructive behavior, including self-harm and suicides, while in solitary units (Cloud et al. 2015; Daniel and Fleming 2006; Kaba et al. 2014; Kupers 1999; Way et al. 2007).

*[Table C-6 about here]*

Table C-7 reports results for illness-related causes. Overall, exposure to solitary confinement is not significantly associated with illness-related causes of mortality after release. One exception is liver or kidney disease. Spending 16 or more days is associated with nearly 4 times the odds of death for this cause. One possible explanation for this finding is increased, excessive, and chronic use of alcohol or illicit substances after release from prison. Finally, results also suggests that more frequent trips to solitary is associated elevated risks of mortality for viral hepatitis and other infectious diseases as well as HIV. Both causes are potentially associated with risky behaviors, such as intravenous drug use and unprotected sex. In sum, examining the relationship between exposure to solitary confinement and specific causes of mortality reveals that elevated odds of risky behaviors and ultimately preventable deaths.

*[Table C-7 about here]*

## Conclusion

This study examines the mortality consequences of solitary confinement, one of the most severe yet under-explored forms of penal punishment. It extends existing work on the health and mortality consequences of incarceration by attending to the heterogeneous experience of imprisonment and focusing on solitary confinement as a consequential exposure. This study represents one of the first attempts to examine multiple dimensions of exposure to solitary confinement and multiple specific causes of mortality after release. Results point to several key findings: First, solitary confinement is associated with a diminished protective effect of incapacitation in prison (relative to time in the community) via increased risks of suicides and accidents. Second, any experience of solitary confinement, regardless of length of exposure, is associated with an elevated risk of all-cause mortality after release from prison. Third, elevated risks of mortality are driven in large by injury-related causes of mortality, primarily homicides, suicides, and transportation accidents, which are all premature causes of death. These findings provide evidence that solitary confinement is an important correlate of mortality even among an already high-risk population of incarcerated individuals.

The detrimental effects of solitary confinement on post-release mortality found in this study suggest that the scars of time spent in solitary is long-lasting. Beyond the established finding that being currently in solitary is associated with increased risks of self-harm and suicide (Cloud et al. 2015; Kaba et al. 2014; Kupers 1999; Way et al. 2007), solitary confinement appears to influence individual well-being long after prison. This is consistent with mounting evidence of the lasting, negative mental health impacts of isolation (Arrigo and Bullock 2007; Grassian 2006; Hagan et al. 2017; Haney 2003a; Haney and Lynch 1997). Moreover, the finding that any exposure is more consequential than the length of exposure is consistent with prior research on the length of incarceration and health (Massoglia and Pridemore 2015) as well as

studies that demonstrate even the shortest stays in solitary can produce lasting damage (Haney and Lynch 1997).

The study identifies pronounced risks of homicides, suicides, and transportation accidents after exposure. Such causes are consistent with the view that solitary confinement induces behavioral adaptations – such as increased aggression, reduced to impulse-control, and suspicion of social interactions – that intensify interpersonal violence, increase risky behaviors, and ultimately elevate the risk of mortality. Moreover, they suggest the underlying impact of solitary confinement on individuals' ability to cope with the stresses, difficulties, and dangers of reentry. Deaths by suicide is of particular concern because of increasing evidence that solitary confinement produces lasting psychological damage as well as the overrepresentation of individuals with mental illness in solitary (Arrigo and Bullock 2007; Fellner 2006; Haney 2003b; Rhodes 2004). More broadly, the widespread use of solitary confinement raises serious public health concerns (Ahalt et al. 2017; Cloud et al. 2015; Williams 2016).

Findings raise serious concerns about the practice of solitary confinement, particularly as a long-term strategy of inmate management. Given the extraordinary scale of mass incarceration, solitary confinement is not an uncommon experience. Data show that 4.4% of state and federal prisoners and 2.7% of jail inmates (together, over 80,000 inmates) are held in solitary on any given day. Between 2011-2012, almost 20% of prisoners and 18% of jail inmates (over 400,000 inmates) have spent time in solitary in the past 12 months (Beck 2015). The disproportionate concentration of disadvantaged and vulnerable individuals in the incarcerated population means that they are at higher risks for exposure to solitary confinement. As such, the negative consequences of solitary confinement may contribute more broadly to health disparities.

I remind the reader of the limitations of this study. First, the study is based in one state, and policies and practices of solitary confinement may vary across states. Second, the follow up period is relatively short, and illness-related morbidity and mortality may take time to manifest. Third, the study is not able to assess heterogeneity in effects by factors such as mental illness history due to limited sample size. Fourth, the study focuses only solitary confinement prison settings, and as such, are not able to identify and evaluate the impacts of solitary confinement in jail settings. Finally, while the study accounts for an extensive set of potential confounders, the highly selective nature of solitary confinement means unobserved confounding poses a threat to causal inference.

Even in light of these limitations, this study identifies solitary confinement as an important risk factor of post-prison mortality. It points to several directions for future research. More research is needed to identify and empirically test specific causal pathways through which solitary confinement elevates the risk of mortality. Moreover, the detrimental effects of solitary confinement may be more pronounced among prisoners who are especially susceptible to the negative effects of social isolation. Future work should investigate variation by key characteristics, such as history of mental illness.

## Tables

Table C-1. Summary Statistics of Time-Varying Exposure Measures

| | Full Sample | | Ever in Solitary Confinement | |
|---|---|---|---|---|
| | Mean / % | SD | Mean / % | SD |
| *Exposure to Solitary Confinement* | 0.20 | 0.40 | - | - |
| *Current Status* | | | | |
| Time in the Community | 0.55 | 0.50 | 0.29 | 0.46 |
| Time in General Prison | 0.42 | 0.49 | 0.57 | 0.49 |
| Time in Solitary Confinement | 0.03 | 0.16 | 0.13 | 0.34 |
| *Cumulative Days in Solitary Confinement* | | | | |
| 0 Days in Solitary | 0.80 | 0.40 | - | - |
| 1-15 Days in Solitary | 0.09 | 0.28 | 0.42 | 0.49 |
| 16+ Days in Solitary | 0.12 | 0.32 | 0.58 | 0.49 |
| *Number of Trips to Solitary Confinement* | 0.97 | 3.52 | 4.76 | 6.54 |
| Observations (Person-Month) | 4,819,124 | | 983,404 | |

Table C-2. Crude Death Rates (per 100,000 Person-Years), Overall Sample

| | Overall | | No Exposure to Solitary Confinement | | Any Exposure to Solitary Confinement | |
|---|---|---|---|---|---|---|
| Status | Deaths | Rate (95% CI) | Deaths | Rate (95% CI) | Deaths | Rate (95% CI) |
| *Injury* | *835* | *223.2 (208.6, 238.9)* | *644* | *211.6 (195.8, 228.6)* | *191* | *274.2 (237.9, 316.0)* |
| Overdose | 279 | 74.6 (66.3, 83.9) | 231 | 75.9 (66.7, 86.3) | 48 | 68.9 (51.9, 91.4) |
| Homicide | 259 | 69.2 (61.3, 78.2) | 199 | 65.4 (56.9, 75.1) | 60 | 86.1 (66.9, 110.9) |
| Suicide | 131 | 35.0 (29.5, 41.6) | 89 | 29.2 (23.8, 36.0) | 42 | 60.3 (44.6, 81.6) |
| Transportation Accidents | 83 | 22.2 (17.9, 27.5) | 61 | 20.0 (15.6, 25.8) | 22 | 31.6 (20.8, 48.0) |
| Falls and Other Accidents | 42 | 11.2 (8.3, 15.2) | 32 | 10.5 (7.4, 14.9) | 10 | 14.4 (7.7, 26.7) |
| Other External Causes | 41 | 11.0 (8.1, 14.9) | 32 | 10.5 (7.4, 14.9) | 9 | 12.9 (6.7, 24.8) |
| *Illness* | *982* | *262.5 (246.6, 279.5)* | *820* | *269.4 (251.6, 288.5)* | *162* | *232.5 (199.4, 271.3)* |
| Cardiovascular Disease | 299 | 79.9 (71.4, 89.5) | 246 | 80.8 (71.3, 91.6) | 53 | 76.1 (58.1, 99.6) |
| Cancer | 239 | 63.9 (56.3, 72.5) | 207 | 68.0 (59.3, 77.9) | 32 | 45.9 (32.5, 65.0) |
| Diabetes and Other Non-Infectious Diseases | 234 | 62.6 (55.0, 71.1) | 203 | 66.7 (58.1, 76.5) | 31 | 44.5 (31.3, 63.3) |
| Viral Hepatitis and Other Infectious Diseases | 70 | 18.7 (14.8, 23.7) | 57 | 18.7 (14.4, 24.3) | 13 | 18.7 (10.8, 32.1) |
| Liver or Kidney Disease | 63 | 16.8 (13.2, 21.6) | 50 | 16.4 (12.4, 21.7) | 13 | 18.7 (10.8, 32.1) |
| Respiratory Disease | 49 | 13.1 (9.9, 17.3) | 40 | 13.1 (9.6, 17.9) | 9 | 12.9 (6.7, 24.8) |
| HIV | 26 | 7.0 (4.7, 10.2) | 15 | 4.9 (3.0, 8.2) | 11 | 15.8 (8.7, 28.5) |
| All-Cause | 1,817 | 485.7 (463.9, 508.6) | 1,464 | 480.9 (456.9, 506.2) | 353 | 506.7 (456.5, 562.4) |

Table C-3. Crude Death Rates (per 100,000 Person-Years), Time in Prison

| | Overall | | No Exposure to Solitary Confinement | | Any Exposure to Solitary Confinement | |
|---|---|---|---|---|---|---|
| Status | Deaths | Rate (95% CI) | Deaths | Rate (95% CI) | Deaths | Rate (95% CI) |
| *Injury* | *52* | *32.1 (24.5, 42.2)* | *28* | *24.3 (16.8, 35.3)* | 24 | *51.2 (34.3, 76.4)* |
| Overdose | 8 | 4.9 (2.5, 9.9) | 5 | 4.3 (1.8, 10.4) | 3 | 6.4 (2.1, 19.9) |
| Homicide | 11 | 6.8 (3.8, 12.3) | 7 | 6.1 (2.9, 12.8) | 4 | 8.5 (3.2, 22.8) |
| Suicide | 28 | 17.3 (11.9, 25.1) | 14 | 12.2 (7.2, 20.6) | 14 | 29.9 (17.7, 50.5) |
| Transportation Accidents | 1 | 0.6 (0.1, 4.4) | 1 | 0.9 (0.1, 6.2) | 0 | - |
| Falls and Other Accidents | 2 | 1.2 (0.3, 4.9) | 0 | - | 2 | 4.3 (1.1, 17.1) |
| Other External Causes | 2 | 1.2 (0.3, 4.9) | 1 | 0.9 (0.1, 6.2) | 1 | 2.1 (0.3, 15.2) |
| *Illness* | *221* | *136.5 (119.7, 155.8)* | *157* | *136.5 (116.7, 159.6)* | *64* | *136.6 (106.9, 174.6)* |
| Cardiovascular Disease | 72 | 44.5 (35.3, 56.0) | 50 | 43.5 (32.9, 57.4) | 22 | 47.0 (30.9, 71.3) |
| Cancer | 71 | 43.9 (34.8, 55.4) | 55 | 47.8 (36.7, 62.3) | 16 | 34.2 (20.9, 55.8) |
| Diabetes and Other Non-Infectious Diseases | 25 | 15.4 (10.4, 22.9) | 18 | 15.7 (9.9, 24.8) | 7 | 14.9 (7.1, 31.3) |
| Viral Hepatitis and Other Infectious Diseases | 21 | 13.0 (8.5, 19.9) | 12 | 10.4 (5.9, 18.4) | 9 | 19.2 (10.0, 36.9) |
| Liver or Kidney Disease | 12 | 7.4 (4.2, 13.1) | 8 | 7.0 (3.5, 13.9) | 4 | 8.5 (3.2, 22.8) |
| Respiratory Disease | 12 | 7.4 (4.2, 13.1) | 10 | 8.7 (4.7, 16.2) | 2 | 4.3 (1.1, 17.1) |
| HIV | 8 | 4.9 (2.5, 9.9) | 4 | 3.5 (1.3, 9.3) | 4 | 8.5 (3.2, 22.8) |
| All-Cause | 273 | 168.7 (149.8, 189.9) | 185 | 160.8 (139.3, 185.8) | 88 | 187.9 (152.4, 231.5) |

Table C-4. Crude Death Rates (per 100,000 Person-Years), Time in the Community

| | Overall | | No Exposure to Solitary Confinement | | Any Exposure to Solitary Confinement | |
|---|---|---|---|---|---|---|
| Status | Deaths | Rate (95% CI) | Deaths | Rate (95% CI) | Deaths | Rate (95% CI) |
| *Injury* | *783* | *369.0 (344.0, 395.8)* | *616* | *325.3 (300.6, 352.0)* | *167* | *731.8 (628.8, 851.6)* |
| Overdose | 271 | 127.7 (113.4, 143.9) | 226 | 119.3 (104.7, 136.0) | 45 | 197.2 (147.2, 264.1) |
| Homicide | 248 | 116.9 (103.2, 132.4) | 192 | 101.4 (88.0, 116.8) | 56 | 245.4 (188.8, 318.9) |
| Suicide | 103 | 48.5 (40.0, 58.9) | 75 | 39.6 (31.6, 49.7) | 28 | 122.7 (84.7, 177.7) |
| Transportation Accidents | 82 | 38.6 (31.1, 48.0) | 60 | 31.7 (24.6, 40.8) | 22 | 96.4 (63.5, 146.4) |
| Falls and Other Accidents | 40 | 18.8 (13.8, 25.7) | 32 | 16.9 (11.9, 23.9) | 8 | 35.1 (17.5, 70.1) |
| Other External Causes | 39 | 18.4 (13.4, 25.2) | 31 | 16.4 (11.5, 23.3) | 8 | 35.1 (17.5, 70.1) |
| *Illness* | *761* | *358.6 (334.0, 385.0)* | *663* | *350.1 (324.4, 377.8)* | *98* | *429.4 (352.3, 523.4)* |
| Cardiovascular Disease | 227 | 107.0 (93.9, 121.8) | 196 | 103.5 (90.0, 119.0) | 31 | 135.8 (95.5, 193.2) |
| Cancer | 168 | 79.2 (68.1, 92.1) | 152 | 80.3 (68.5, 94.1) | 16 | 70.1 (43.0, 114.4) |
| Diabetes and Other Non-Infectious Diseases | 209 | 98.5 (86.0, 112.8) | 185 | 97.7 (84.6, 112.8) | 24 | 105.2 (70.5, 156.9) |
| Viral Hepatitis and Other Infectious Diseases | 49 | 23.1 (17.5, 30.6) | 45 | 23.8 (17.7, 31.8) | 4 | 17.5 (6.6, 46.7) |
| Liver or Kidney Disease | 51 | 24.0 (18.3, 31.6) | 42 | 22.2 (16.4, 30.0) | 9 | 39.4 (20.5, 75.8) |
| Respiratory Disease | 37 | 17.4 (12.6, 24.1) | 30 | 15.8 (11.1, 22.7) | 7 | 30.7 (14.6, 64.3) |
| HIV | 18 | 8.5 (5.3, 13.5) | 11 | 5.8 (3.2, 10.5) | 7 | 30.7 (14.6, 64.3) |
| All-Cause | 1,544 | 727.6 (692.2, 764.8) | 1,279 | 675.3 (639.3, 713.4) | 265 | 1,161.2 (1,029.5, 1,309.8) |

Table C-5. Exposure and All-Cause, Injury-Related, and Illness-Related Mortality

| | All-Cause | | Injury Deaths | | Illness Deaths | |
|---|---|---|---|---|---|---|
| | coef. | haz. ratio | coef. | haz. ratio | coef. | haz. ratio |
| *Current Status* | | | | | | |
| In General Prison (ref: In the Community) | -1.585*** | 0.205*** | -2.738*** | 0.065*** | -1.008*** | 0.365*** |
| | (0.079) | (0.016) | (0.169) | (0.011) | (0.093) | (0.034) |
| In Solitary Confinement | -0.931** | 0.394** | -1.539** | 0.215** | -0.352 | 0.704 |
| | (0.324) | (0.128) | (0.485) | (0.104) | (0.436) | (0.307) |
| *Total Days in Solitary* | | | | | | |
| 1-15 Days (ref: 0) | 0.388*** | 1.475*** | 0.562*** | 1.754*** | 0.222 | 1.248 |
| | (0.085) | (0.126) | (0.118) | (0.208) | (0.125) | (0.155) |
| 16+ Days | 0.402*** | 1.495*** | 0.610*** | 1.840*** | 0.206 | 1.229 |
| | (0.121) | (0.181) | (0.151) | (0.278) | (0.187) | (0.230) |
| *Number of Spells in Solitary* | 0.005 | 1.005 | 0.008 | 1.008 | 0.010 | 1.010 |
| | (0.014) | (0.014) | (0.015) | (0.015) | (0.022) | (0.022) |
| Subjects | 43,104 | | 43,104 | | 43,104 | |
| Person-Month Observations | 4,466,970 | | 4,466,970 | | 4,466,970 | |
| Failures | 1,628 | | 741 | | 885 | |

Standard errors in parentheses. *** p<0.001, ** p<0.01, * p<0.05

Note: All models adjust for time-varying time in prison and time-invariant demographic factors (race, age, gender, marital status), human capital (education and pre-sentence employment), health-related measures (mental illness history, body mass index, health insurance at sentencing, physical disability, substance use), criminal history (prior arrests, prior felony convictions, prior adult jail commitments, prior adult prison commitments, time in prison prior to sentencing, and prior in-prison misconducts), assault risk assessments, and sentencing guidelines factors (crime type and offense severity score).

Table C-6. Exposure and Specific Causes of Injury-Related Mortality

| | Overdose | Homicide | Suicide | Transportation Accidents | Falls and Other Accidents | Other External Causes |
|---|---|---|---|---|---|---|
| | haz. ratio | haz. ratio | haz. ratio | haz. ratio | haz. ratio | haz. ratio |
| *Current Status* | | | | | | |
| In General Prison (ref: In the Community) | 0.055*** | 0.030*** | 0.181*** | 0.000*** | 0.052** | 0.086** |
| | (0.020) | (0.012) | (0.048) | (0.000) | (0.051) | (0.067) |
| In Solitary Confinement | 0.000*** | 0.068* | 0.454 | 0.000*** | 3.919 | 0.000*** |
| | (0.000) | (0.071) | (0.316) | (0.000) | (4.028) | (0.000) |
| *Total Days in Solitary* | | | | | | |
| 1-15 Days (ref: 0) | 1.530* | 1.833** | 2.001* | 2.474** | 3.432** | 1.149 |
| | (0.330) | (0.405) | (0.616) | (0.835) | (1.523) | (0.752) |
| 16+ Days | 1.136 | 1.698* | 3.266*** | 2.791* | 4.007 | 2.332 |
| | (0.444) | (0.417) | (1.022) | (1.298) | (3.324) | (1.562) |
| *Number of Spells* | 0.972 | 1.031 | 1.009 | 0.998 | 0.765* | 0.959 |
| | (0.053) | (0.020) | (0.024) | (0.048) | (0.098) | (0.071) |
| Observations | 4,466,970 | 4,466,970 | 4,466,970 | 4,466,970 | 4,466,970 | 4,466,970 |
| Subjects | 43,104 | 43,104 | 43,104 | 43,104 | 43,104 | 43,104 |
| Failures | 252 | 219 | 117 | 79 | 37 | 37 |

Standard errors in parentheses. *** p<0.001, ** p<0.01, * p<0.05

Note: All models adjust for time-varying time in prison and time-invariant demographic factors (race, age, gender, marital status), human capital (education and pre-sentence employment), health-related measures (mental illness history, body mass index, health insurance at sentencing, physical disability, substance use), criminal history (prior arrests, prior felony convictions, prior adult jail commitments, prior adult prison commitments, time in prison prior to sentencing, and prior in-prison misconducts), assault risk assessments, and sentencing guidelines factors (crime type and offense severity score).

Table C-7. Exposure and Specific Causes of Illness-Related Mortality

| | Cardiovascular Disease | Cancer | Diabetes and Other Non-Infectious Diseases | Viral Hepatitis and Other Infectious Diseases | Liver or Kidney Disease | Respiratory Disease | HIV |
|---|---|---|---|---|---|---|---|
| | haz. ratio | haz. ratio | haz. ratio | haz. ratio | haz. ratio | haz. ratio | haz. ratio |
| *Current Status* | | | | | | | |
| In General Prison (ref: In the Community) | 0.372*** | 0.563** | 0.140*** | 0.658 | 0.370** | 0.408* | 0.220** |
| | (0.063) | (0.103) | (0.035) | (0.177) | (0.130) | (0.160) | (0.122) |
| In Solitary Confinement | 0.764 | 0.000*** | 1.153 | 0.860 | 0.000*** | 0.000*** | 0.643 |
| | (0.621) | (0.000) | (0.817) | (0.877) | (0.000) | (0.000) | (0.689) |
| *Total Days in Solitary* | | | | | | | |
| 1-15 Days (ref: 0) | 1.281 | 1.243 | 1.352 | 1.197 | 1.925 | 1.825 | 2.214 |
| | (0.289) | (0.345) | (0.349) | (0.519) | (0.820) | (0.979) | (1.536) |
| 16+ Days | 1.645 | 1.686 | 1.226 | 0.509 | 3.998* | 1.538 | 3.632 |
| | (0.449) | (0.802) | (0.581) | (0.260) | (2.295) | (1.139) | (2.456) |
| *Number of Spells* | 0.970 | 0.880 | 0.955 | 1.110*** | 0.887 | 0.886 | 1.074* |
| | (0.036) | (0.079) | (0.063) | (0.022) | (0.080) | (0.075) | (0.031) |
| Observations | 4,466,970 | 4,466,970 | 4,466,970 | 4,466,970 | 4,466,970 | 4,466,970 | 4,466,970 |
| Subjects | 43,104 | 43,104 | 43,104 | 43,104 | 43,104 | 43,104 | 43,104 |
| Failures | 272 | 218 | 210 | 64 | 58 | 41 | 22 |

Standard errors in parentheses. *** p<0.001, ** p<0.01, * p<0.05

Note: All models adjust for time-varying time in prison and time-invariant demographic factors (race, age, gender, marital status), human capital (education and pre-sentence employment), health-related measures (mental illness history, body mass index, health insurance at sentencing, physical disability, substance use), criminal history (prior arrests, prior felony convictions, prior adult jail commitments, prior adult prison commitments, time in prison prior to sentencing, and prior in-prison misconducts), assault risk assessments, and sentencing guidelines factors (crime type and offense severity score).

Table C-S1. Summary Statistics of Baseline Characteristics

| | Full Sample | | Ever in Solitary Confinement | | Never in Solitary Confinement | |
|---|---|---|---|---|---|---|
| | Mean / % | SD | Mean / % | SD | Mean / % | SD |
| *Demographic Characteristics* | | | | | | |
| Non-White | 0.47 | 0.50 | 0.50 | 0.50 | 0.45 | 0.50 |
| Female | 0.07 | 0.26 | 0.08 | 0.27 | 0.07 | 0.26 |
| Age at Sentence | 31.33 | 10.50 | 28.79 | 9.91 | 32.66 | 10.56 |
| Single | 0.70 | 0.46 | 0.77 | 0.42 | 0.66 | 0.47 |
| Known Homosexual | 0.01 | 0.08 | 0.01 | 0.09 | 0.01 | 0.07 |
| *Human Capital* | | | | | | |
| Less than HS | 0.45 | 0.50 | 0.50 | 0.50 | 0.43 | 0.49 |
| GED | 0.20 | 0.40 | 0.20 | 0.40 | 0.19 | 0.39 |
| HS | 0.28 | 0.45 | 0.24 | 0.43 | 0.30 | 0.46 |
| More than HS | 0.07 | 0.25 | 0.05 | 0.23 | 0.07 | 0.26 |
| Pre-Sentence Employment | 0.29 | 0.28 | 0.22 | 0.25 | 0.32 | 0.29 |
| *Health and Substance Abuse* | | | | | | |
| History of Mental Illness | 0.19 | 0.39 | 0.23 | 0.42 | 0.17 | 0.37 |
| Underweight | 0.01 | 0.11 | 0.01 | 0.11 | 0.01 | 0.10 |
| Normal Weight | 0.46 | 0.50 | 0.47 | 0.50 | 0.45 | 0.50 |
| Overweight | 0.37 | 0.48 | 0.36 | 0.48 | 0.37 | 0.48 |
| Obese | 0.17 | 0.37 | 0.16 | 0.37 | 0.17 | 0.38 |
| History of Alcohol use | 0.69 | 0.46 | 0.66 | 0.47 | 0.71 | 0.46 |
| History of Marijuana Use | 0.68 | 0.47 | 0.69 | 0.46 | 0.67 | 0.47 |
| History of Stimulants Use | 0.42 | 0.49 | 0.39 | 0.49 | 0.43 | 0.49 |
| History of Opioids Use | 0.15 | 0.35 | 0.15 | 0.35 | 0.15 | 0.36 |
| History of Other Drug Use | 0.24 | 0.43 | 0.26 | 0.44 | 0.23 | 0.42 |
| Health Insurance at Sentencing | 0.24 | 0.42 | 0.24 | 0.43 | 0.24 | 0.42 |
| Physical Disability | 0.36 | 0.48 | 0.35 | 0.48 | 0.36 | 0.48 |
| *Criminal History* | | | | | | |
| 0-4 Prior Arrests | 0.28 | 0.45 | 0.30 | 0.46 | 0.28 | 0.45 |
| 5-9 Prior Arrests | 0.31 | 0.46 | 0.31 | 0.46 | 0.31 | 0.46 |
| 10+ Prior Arrests | 0.40 | 0.49 | 0.40 | 0.49 | 0.41 | 0.49 |
| Prior Felony Convictions | 2.10 | 2.97 | 2.02 | 3.08 | 2.14 | 2.90 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Prior Adult Jail Commitments | 2.78 | 3.84 | 2.61 | 3.83 | 2.86 | 3.85 |
| Prior Adult Prison Commitments | 0.97 | 1.67 | 0.99 | 1.78 | 0.96 | 1.61 |
| Prior Months in Prison | 22.66 | 43.60 | 25.33 | 47.21 | 21.27 | 41.53 |
| Prior In-Prison Violent Misconduct | 0.13 | 0.34 | 0.18 | 0.39 | 0.10 | 0.30 |
| Prior In-Prison Drug Misconduct | 0.13 | 0.33 | 0.14 | 0.34 | 0.12 | 0.32 |
| Prior In-Prison Contraband Misconduct | 0.12 | 0.32 | 0.16 | 0.36 | 0.10 | 0.29 |
| Prior In-Prison Disobeying Misconduct | 0.25 | 0.43 | 0.30 | 0.46 | 0.23 | 0.42 |
| *Statistical Risk Assessments* | | | | | | |
| Low Assault Risk | 0.51 | 0.50 | 0.37 | 0.48 | 0.58 | 0.49 |
| Middle Assault Risk | 0.47 | 0.50 | 0.58 | 0.49 | 0.40 | 0.49 |
| High Assault Risk | 0.02 | 0.15 | 0.05 | 0.21 | 0.01 | 0.11 |
| Low Property Risk | 0.39 | 0.49 | 0.33 | 0.47 | 0.43 | 0.49 |
| Middle Property Risk | 0.41 | 0.49 | 0.39 | 0.49 | 0.42 | 0.49 |
| High Property Risk | 0.20 | 0.40 | 0.28 | 0.45 | 0.15 | 0.36 |
| *Sentencing Factors* | | | | | | |
| Sentenced to Jail at Baseline | 0.07 | 0.25 | 0.07 | 0.25 | 0.07 | 0.25 |
| Sentenced to Jail and Probation at Baseline | 0.26 | 0.44 | 0.24 | 0.43 | 0.27 | 0.44 |
| Sentenced to Prison at Baseline | 0.53 | 0.50 | 0.55 | 0.50 | 0.52 | 0.50 |
| Sentenced to Probation at Baseline | 0.15 | 0.35 | 0.15 | 0.35 | 0.15 | 0.36 |
| Controlled Substance Crime | 0.20 | 0.40 | 0.15 | 0.36 | 0.23 | 0.42 |
| Violent Crime | 0.38 | 0.49 | 0.46 | 0.50 | 0.34 | 0.47 |
| Property Crime | 0.25 | 0.43 | 0.25 | 0.43 | 0.24 | 0.43 |
| Public Order Crime | 0.03 | 0.18 | 0.02 | 0.15 | 0.04 | 0.19 |
| Public Safety Crime | 0.14 | 0.35 | 0.12 | 0.33 | 0.15 | 0.36 |
| Total Offense Severity Score | 22.98 | 28.37 | 27.56 | 33.16 | 20.59 | 25.19 |
| Violent Offense in Sentence Cluster | 0.42 | 0.49 | 0.50 | 0.50 | 0.38 | 0.48 |
| Length of Prison Sentence | 24.83 | 53.18 | 37.41 | 74.51 | 18.26 | 35.75 |
| Observations | 46,513 | | 15,965 (34.3%) | | 30,548 (65.7%) | |

# CONCLUSION

The rise and widespread use of solitary confinement reflects the culture of punitive penal policies and practices in the United States. We are at a historic moment when some of the most extreme forms of punishment are not only tolerated but embraced – often without critical considerations of their effectiveness, nor their potential collateral consequences. This study is an attempt to shed light on the determinants and consequences of solitary confinement and to unpack how the nature of imprisonment shapes the lives and well-being of individuals. The overall findings from this study suggest that in the long-run solitary confinement is not only counterproductive but also harmful to individual well-being. This conclusion, notably, is not very different from the conclusion drawn by reformers and observers of the earliest experiment on solitary confinement during the early 1800s in this country.

Findings from the study have important implications with regard to punishment and inequality, public health, and public safety. Punitive practices like solitary confinement and its attendant consequences can further marginalize some of the most disadvantaged and vulnerable individuals from society. Criminogenic behaviors and subsequent involvement with the criminal justice system as result of solitary confinement threatens public safety and perpetuates the revolving door of imprisonment. Premature and excess mortality associated with exposure to solitary confinement raises serious public health concerns, particularly for an already disadvantaged and vulnerable population.

This study raises serious concerns about the practice of solitary confinement, particularly as a long-term strategy of inmate management. Concerns about the safety of prisoners and staff are indeed legitimate. To be sure, individuals who commit deplorable acts while in custody may warrant being segregated from the general population for periods of time. However, solitary confinement has not been shown to be effective in reducing in infractions and institutional violence (Briggs et al. 2003; Labrecque 2015; Lucas and Jones 2017; Morris 2016). In fact, it appears to no longer be reserved for such circumstances as it is increasingly used to punish and contain more and more prisoners, including some of the most vulnerable (such as those with mental illness). The fiscal costs and public safety and public health consequences warrant a reassessment of this practice.

*Policy Implications*

In recent years, there is increasingly recognition among diverse stakeholders, including advocates, policymakers, correctional administrators, and medical professionals that serious reform efforts are needed to reduce the use of solitary confinement (ACLU 2014a; Ahalt and Williams 2016; Cloud et al. 2015; Haney 2017; Méndez 2011; Moran 2014; Obama 2016; U.S. Congress 2012; U.S. Department of Justice 2016). A key focus of this movement is the need to establish a systematic approach to reducing the numbers of individuals in solitary confinement (ACLU 2013). This means (a) limiting entry, (b) reducing time in solitary, and (c) developing programs to support the transition from solitary to the general prison population and society. These reform efforts include a number of key policy changes: (1) restricting the criteria for entry into solitary confinement and using it as a tool of last resort; (2) limiting stays to as to be brief as possible; (3) clearly articulating to individuals the steps required to exit solitary units; (4) requiring regular and close monitoring of individuals in solitary by trained mental health

professionals; (5) establishing "step-down" and transitional programs to assist individuals returning from solitary units; (6) providing additional training to staff regarding alternatives techniques for managing difficult individuals; (7) housing vulnerable individuals in separate units with access to services and programs instead of segregating them in solitary; (8) eliminating the use of solitary confinement entirely for vulnerable populations such as those with mental illness, juveniles and pregnant or nursing women. Even prisoners themselves have mobilized for reforms of solitary confinement (Reiter 2017). Efforts to drastically reduce the number of individuals held in solitary confinement are already underway in a number of state prison systems, including in California, Colorado, Idaho, Maine, and North Dakota (Haney 2017).

There are several notable successes across the country. Maine, as part of its reform efforts, reduced its segregated population by more than half and did not experience any significant increase in violent acts (ACLU 2013; U.S. Department of Justice 2016). Moreover, individuals held in its Special Management Units for longer than 72 hours now requires approval of the commissioner of corrections (ACLU 2013). Similarly, Colorado substantially reduced the number of prisoners in solitary confinement in 2011 and limited the criteria for placing inmates in solitary confinement. It also banned the use of solitary confinement of seriously mentally ill individuals (U.S. Department of Justice 2016). At the federal level, the Department of Justice recommends several alternatives to administrative, punitive, and protective isolation (U.S. Department of Justice 2016). With regard to punitive segregation, this means implementing and standardizing a system of graduated sanctions, where solitary confinement is used as a tool of last resort. Intermediate sanctions include delay of parole date, forfeit of good time, loss of privileges, change housing quarters, remove from program and group activity, and extra duty.

Alternatives for administrative segregation include establishing a separate, treatment-oriented unit for individuals with serious mental illness that includes cognitive behavioral therapy for those with substance abuse and mental illness. Alternatives to protective isolation include transitional programs for individuals at risk of victimization because of the nature of their crimes, such as sex offenders, and those who drop-out of gangs (U.S. Department of Justice 2016:94–103). These efforts, together, demonstrate that there need not be a tradeoff between reducing the population in solitary confinement and institutional safety.

*Michigan Context*

Correctional policies and practices may vary widely across jurisdictions, and as such, caution should be exercised in generalizing findings from this study to other contexts. How Michigan compares to other contexts is indeed important to consider. The state, overall, represents an average state across all jurisdictions, both in terms of use of imprisonment and use of solitary confinement. In 2016 the year-end prison population in Michigan was 41,122, and the corresponding imprisonment rate was 414 per 100,000 (ranking 19$^{th}$ highest among states), compared to 450 for the U.S. as a whole. In 2015, it was 430 per 100,000 (17$^{th}$ highest among states) compared to 459 for the U.S. overall (Carson 2018). In terms of solitary confinement (or "restrictive housing"), 3.1% of the correctional population in Michigan (42,826 in the fall of 2015) was held in restrictive housing, according to the ASCA-Liman report (2016), the only available source of comparison across states. The average percent of the correctional population in restrictive housing in the U.S. correctional population across all reporting jurisdictions was 4.9% (the median was 5.1%). Together, these numbers suggest that Michigan may be more reflective of an average state; moreover, more punitive practices and greater use of solitary confinement in other contexts may yield larger estimates, especially regarding impacts public

safety and public health. More data are needed, however, to compare incidence rates and the average length of time individuals spend in solitary confinement.

There are also recent reform efforts in Michigan that are indicative of a broader movement to reduce the use of administrative segregation. Legislative reports indicate that the daily average number of prisoners in administrative segregation in 2007-08 year (the earliest numbers available) was 1,314, while in the 2016-17 year, the daily average was 810, representing a 38% reduction (Michigan Department of Corrections 2017). The average length of time in administrative remains steady, at about 365 days. The number of individuals held in administrative segregation who have serious mental illness or developmental disorder has fluctuated throughout the years, but it remains comparable in the fiscal years 2007-8 and 2016-7 year. There are two notable initiatives to reduce the use of restrictive housing: the Incentives in Segregation Program (IISP) and the Start Unit Program. The IISP is a pilot program designed to encourage appropriate behavior in segregation by establishing a six-stage progression of expectations and incentives, that when completed would serve as grounds for release into lower-security confinement. The Start Unit Program is an initiative designed to divert seriously mentally ill individuals away from administrative segregation through the use of a separate, therapeutic housing unit that provides personal skills development as well as mental health services. Both are a positive sign of a movement to reduce the use of long-term solitary confinement.

*Research Implications*

The current state of the literature calls for more systematic data collection on the use of solitary confinement and more rigorous research on its effectiveness and consequences. A key challenge to data collection and research is the lack of a standard terminology and definition for

the practice of isolating individuals. Terminologies vary widely across jurisdictions and include terms such as security housing units, special management units, control units, administrative maximum, lockdown, and more colloquially, "the hole" (U.S. Department of Justice 2016). Moreover, in social science research (as in this study), the term "solitary confinement" is commonly used to emphasize the social condition of isolation, while correctional officials have tended to prefer the more general terms "segregation" and "restrictive housing." Systemic data collection also requires a standardized definition of the practice of isolating individuals. In a recent report, the Department of Justice recommends defining "restrictive housing" as consisting of three conditions: *(a) removal from the general inmate population, whether voluntary or involuntary, (b) placement in a locked room or cell, whether alone or with another inmate, and (c) inability to leave the room or cell for the vast majority of the day, typically 22 hours or more* (U.S. Department of Justice 2016:3). Together, a standardized terminology and definition can be incorporated into correctional data collection systems, which would allow aggregation at the national-level and permit cross-jurisdiction comparisons.

Despite concerns about the practice of solitary confinement, even reliable statistics on its use – prevalence, incidence, and length of stay – are not readily available for all states. The *Time-In-Cell* (2015) report and its follow up, *Aiming to Reduce Time-In-Cell* (2016), by the Arthur Liman Public Interest Program (Liman) and the Association of State Correctional Administrators (ASCA) represent the best data available on the prevalence of restrictive housing. Across all reporting jurisdictions, the median percentage of the correctional population held in restrictive housing in the fall of 2015 was 5.1% (mean was 4.9%), with a low of 0.5% (Hawaii) and high of 28.3% (Virgin Islands) (ASCA and Arthur Liman Public Interest Program 2016:22–23). The report also provided statistics on the duration of time individuals spent in restrictive

housing. Among prisoners in 41 of the 53 reporting jurisdictions, 18% spent 15 days to 1 month in restrictive housing, 29% 1 to 3 months, 26% 3 months to 1 year, 13% 1 to 3 years, and about 11% 3 years or more (ASCA and Arthur Liman Public Interest Program 2016:28). This indicates that for many, restrictive housing is a long-term sentence. Incidence rates require observation of prisoners over time, as such, are less widely available. A recent report by the Bureau of Justice Statistics found that 20% of prisoners and 18% of those held in jail in 2011-2012 were held in restrictive housing at some point in the prior 12 months (Beck 2015).

Systematic data collection will permit rigorous evaluations of the effectiveness and consequences of solitary confinement, including behavioral changes with regard to institutional violence, misconduct, and future criminal justice contact. As some have noted, there are competing and often contradictory goals of solitary confinement, which require more explicit empirical investigation (Mears 2016). There is a need for more evaluations of the impact of solitary confinement on institutional safety, including assaults against inmates and staff. Existing research has shown that solitary confinement is associated mixed effect on institutional safety (Briggs et al. 2003). Moreover, any deterrent impact of solitary confinement on future institutional misconducts warrants more investigation. Current studies have shown that there is no significant impact of solitary confinement on future rate of misconducts (Labrecque 2015; Lucas and Jones 2017; Morris 2016). Because the majority of prisoners, including those held in solitary confinement, are eventually released back into the community, it is critical to assess impacts on future criminal justice involvement, including rates of violent crimes. These evaluations require tracking individuals over time and linking experiences in prison with future criminal justice involvement. Finally, it is also important to assess the collateral consequences of solitary confinement on individual outcomes outside the criminal justice system. These outcomes

include spillover impacts on health and mortality, employment, social relationships, and other dimensions of reentry.

A key barrier to research on this topic is the highly selective nature of solitary confinement, which makes it difficult to separate cause and effect. Factors that are correlated with exposure to solitary confinement are likely to also correlated with potential outcomes, such as future criminal justice contact and individual well-being. The first chapter of this study has demonstrated that conditional on predictors of behavioral risk that include criminal history and statistical risk assessments, key social statuses – race, age, and a history of mental illness – are associated with exposure. However, unobserved factors, such as impulsivity and personality, may be a source of potential confounding. More sophisticated methods and longitudinal data are needed to address this potential threat. There are several viable methods to establish more appropriate counterfactuals. Propensity score methods, such as those employed in Chapter 2, condition on differential probability and risk of exposure to treatment in order to isolate the effect of solitary confinement on individual outcomes, such as future criminal justice contact. While this method does not directly address unobserved confounding, a sensitivity analysis can be employed to evaluate and quantify the influence of omitted variable bias. Under certain circumstances, it may be possible to exploit the randomization of cell assignment and any discontinuity in statistically scoring and security assessment as a source of exogenous variation in exposure to solitary confinement (e.g., Drago et al. 2011). This approach would offer a solution to both observed and unobserved confounding. Longitudinal data can also help establish proper temporal ordering to make inferences. Chapter 3, for instance, leverages multiple observations of individuals over time to estimate the relationship between exposure to solitary confinement and risk of mortality. Solitary confinement represents one of the most consequential

exposure that intensifies the effects of incarceration. As such, there is a need to for better data collection and more rigorous evaluations of its effectiveness and consequences.

An evaluation of solitary confinement should not only attend to costs and consequences but should also consider human rights concerns. Poor living conditions, long periods without meaningful social interaction, prohibition of family contact, among other conditions of solitary confinement, to some, constitute degrading and inhumane treatment and, in the case of prolonged or indefinite spells, amount to torture (ACLU 2014a; United Nations 2015). The U.N. Special Rapporteur on Torture concluded that isolation of as little as 15 days can produce lasting damage, and as such, should be considered a form of torture (Méndez 2011). Because being human is relational, the sustained denial of meaningful social contact in solitary confinement amounts to what some has termed a "social death", or an undermining of one's very sense of self and an untethering from the social world (Casella et al. 2016; Guenther 2013). The way forward is a serious rethinking of what has become a taken-for-granted acceptance of some of the most extreme forms of punishment.

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